

EXPLORATION—BRITISH NORTH AMERICA.

P A P E R S

RELATIVE TO THE

EXPLORATION

BY CAPTAIN PALLISER

OF THAT PORTION OF

BRITISH NORTH AMERICA

WHICH LIES BETWEEN

THE NORTHERN BRANCH OF THE RIVER SASKATCHEWAN AND
THE FRONTIER OF THE UNITED STATES; AND
BETWEEN THE RED RIVER AND ROCKY MOUNTAINS.

Presented to both Houses of Parliament by Command of Her Majesty.
June 1859.



LONDON:

PRINTED BY GEORGE EDWARD EYRE AND WILLIAM SPOTTISWOODE,
PRINTERS TO THE QUEEN'S MOST EXCELLENT MAJESTY.
FOR HER MAJESTY'S STATIONERY OFFICE.

1859.

SCHEDULE.

No. in Series.	From whom.	Number and Date.	Subject.	Page.
1	The Right Hon. H. Labouchere, M.P., to Capt. Palliser.	March 31, 1857	Instructions to Capt. Palliser	3
2	Capt. Palliser to the Secretary of State for the Colonies.	June 10, 1857	First Report	4
3	Ditto ditto	June 16, 1857	Second Report	5
4	Ditto ditto	July 27, 1857	Third Report	11
5	Ditto ditto	Dec. 8, 1857	Fourth Report	12
6	Ditto ditto	May 3, 1858	Fifth Report <i>Revision on Wilson R. & H. & C. Prelim. Gen. Rep.</i>	16
7	Ditto ditto	June 5, 1858	Sixth Report	27
8	Ditto ditto	Oct. 7, 1858	Seventh Report	29
9	Ditto ditto	Jan. 10, 1859	Eighth Report	41

P A P E R S

RELATIVE TO THE

EXPLORATION OF BRITISH NORTH AMERICA.

No. 1.

No. 1.

COPY of INSTRUCTIONS from the SECRETARY of STATE to Captain PALLISER.

SIR, Downing Street, March 31, 1857.

WITH reference to the Letter which, by my directions, was addressed to you on the 28th inst., I have now the honour to communicate to you Special Instructions for your guidance in the conduct of the Expedition for exploring that portion of British North America which lies between the northern branch of the River Saskatchewan and the frontier of the United States, and between the Red River and the Rocky Mountains.

Having completed all preliminary arrangements necessary for the future safety and success of the Expedition, it is the desire of Her Majesty's Government that you should proceed by the Sault Ste. Marie on Lake Superior to Fort William, and from thence by the Kaministiquia as far as the Kakabeka Falls, and that you should ascertain the precise geographical position of the point at which the White Fish River falls into the Kaministiquia. From thence it is desired that a party should be detached to explore the country to the westward towards the height of land, and, as far as may be practicable, without long delay, to determine the height and direction of the watershed for some distance on either side of the line due west from the White Fish River.

If this preliminary Exploration should lead you to think such a measure practicable, it would be desirable that you should detach a small party, lightly equipped, and supplied with provisions for a few days' march, who should pursue a line directly to the westward, meeting the ordinary canoe route either at Cross Lake or Sturgeon Lake.

From the point at which this party shall rejoin the rest of the Expedition you will proceed by the ordinary route to Fort Garry on the Red River.

In regard to the entire region lying between Lake Superior and Lake Winnipeg, it is desirable that, in addition to the ordinary observations upon the physical features and geology of the country, the attention of all the members of the Expedition should be directed to ascertain the relative levels of all the points which can be recorded and laid down with topographical accuracy; as, for instance, the height of the falls and rapids on the streams which lie along the canoe route, and the relative height of the several points in the watershed between the above-mentioned lakes which may be visited by the Expedition. In case, as is probable, the botanical collector should not accompany the separate exploring party, information should nevertheless be obtained as to the nature and quantity of timber which may be found on the line of march.

From Fort Garry you will start, as soon as you have organized your party, in a westwardly direction, taking such a course as you shall consider most advisable for acquiring additional knowledge of the country on either side of the Bow River or south branch of the Saskatchewan River during the remainder of the season of 1857, and you will make arrangements in advance for wintering the Expedition at Carlton House, where you will meet Lieut. Blakiston.

At the commencement of the season of 1858 you will start, as soon as the weather is sufficiently open and favourable, to explore the country between the two branches of the Saskatchewan River and south of the southern branch, and thence proceeding westward to the head waters of that river, you will endeavour, from the best information you can collect, to ascertain whether one or more practicable passes exist over the Rocky Mountains within the British territory, and south of that known to exist between Mount Brown and Mount Hooker.

PAPERS RELATIVE TO THE

Great care must be taken that the Expedition shall return to Fort Garry in sufficient time to allow them to reach England, via Fort Pembina and the United States, in the fall of 1858.

In the event of your yourself desiring to proceed westward from the Rocky Mountains to Vancouver's Island, Her Majesty's Government consent to your doing so only under the express conditions that the homeward-conduct of the Expedition can with perfect prudence be entrusted to the charge of Lieut. Blakiston or Dr. Hector, and that the expenses of your travelling from Vancouver's Island are defrayed from your own resources; and, further, that the Indian war now raging in the country west of the Rocky Mountains shall have terminated.

It being the desire of Her Majesty's Government that the Expedition should, as far as practicable, be made available for extending general as well as special scientific knowledge, I have to impress upon you the importance, in addition to maintaining a regular series of instrumental observations, of regularly recording the physical features of the country through which you will pass, noting its principal elevations, the nature of its soil, its capability for agriculture, the quantity and quality of its timber, and any indications of coal or other minerals.

Separate Instructions will be furnished by Major-General Sabine, Sir Roderick Murchison, and Sir William Hooker for the guidance of the scientific gentlemen attached to the Expedition.

The result of your surveys and observations should be embodied in a Journal of the Expedition, to be kept with the utmost practicable regularity. A duplicate of that Journal, and of any special observations and reports on the geology and natural history of the country, should be completed at all convenient stations, and forwarded at every favourable opportunity to England, addressed to Her Majesty's Principal Secretary of State for the Colonies, Downing Street, London.

In full reliance upon your ability and discretion, Her Majesty's Government have not hesitated to entrust to you the conduct of the Expedition, with the express understanding that the scientific gentlemen of your party will consider themselves subject to your authority, and bound to be guided explicitly by the orders which your experience may suggest for the safety of the Expedition and for the complete success of the objects for which it is undertaken.

In the event of any unforeseen accident which might deprive the Expedition of your services as leader, the command of the party may be entrusted by you either to Lieut. Blakiston or to Dr. Hector, and you will furnish a duplicate copy of these Instructions to whichever officer you may select for that purpose.

In conclusion, I cannot too earnestly impress upon you the necessity for the utmost caution in the selection of the line of route to be taken by the Expedition, and in avoiding all risk of hostile encounters with any native tribes who may inhabit the country through which you may pass.

I have to request that you will communicate to me, for the information of the Lords Commissioners of the Treasury, the mode in which the expenditure incurred by you while in the territories under the control of the Hudson's Bay Company is to be defrayed, and you will understand that the limits of expense prescribed for the Expedition cannot be exceeded unless under circumstances of urgent necessity, which you will at once report for the information of Her Majesty's Government.

Captain Palliser
&c. &c.

I have, &c.
(Signed) H. LABOUCHERE.

No. 2.

No. 2.

COPY of REPORT from CAPTAIN PALLISER to HER MAJESTY'S
SECRETARY OF STATE FOR THE COLONIES.

SIR,

Sault Sainte Marie, June 10, 1857.
(Received July 3, 1857.)

I HAVE the honour to report my arrival here at 4 o'clock A.M. this morning. We started from Liverpool in the "Arabia" steamer, which left England at 3 P.M., May 16, and landed at New York at 6 P.M. on the 28th May.

Immediately on landing, we experienced some difficulty with the Custom House at New Jersey, and subsequently were enabled to pass our instruments through, owing to the kind assistance of Mr. Pompelly, of New York, whose acquaintance we casually made at our hotel next morning. Mr. Pompelly, aided by Mr. Wheatley, well known as an

accomplished mineralogist in the scientific world, accompanied us on the 29th May to the Custom House, and having explained the objects of our Expedition, and representing it as one directed by Her Britannic Majesty's Government, these gentlemen at length succeeded in accomplishing our object of passing the instruments, saddles, guns, &c., but not until they had called on the Solicitor of the Customs, and conferred with the Superintendent, and several of the subordinate officers of the Custom House. I have entered into these minutiae, as I consider the kindness of these two gentlemen (Mr. Pompelly and Mr. Wheatley), and their anxiety in the furtherance of international science, deserving of the highest praises.

I am much concerned at having to report, about this date, the bursting of one of our new barometers. I am fully convinced that this accident has not occurred from the relaxation of Dr. Hector's vigilance over the barometers, which has been most unremitting. I therefore had the instrument examined by the first makers in New York, who agreed that it might have arisen from the tightness of the metal fittings enclosing the cistern, which prevented its due expansion with a great rise in temperature, such as we experienced on landing at New York.

Mr. Pompelly, however, most kindly applied for us, and obtained one of the New York Observatory barometers, until such time as ours could be repaired and forwarded to Carlton House, or otherwise reclaimed.

On the morning of 2d June we started for Detroit, via Elmira and the Niagara Falls. At Detroit we were detained several days, as the steamer to the Sault Sainte Marie had not yet returned; she, however, arrived on Saturday the 6th, reporting much ice still floating on Lake Superior, and also that Sir George Simpson was still detained at the Sault Sainte Marie by the ice. We have, therefore, no longer any reason to regret the delay of our departure from England, as all progress, owing to the very unusual lateness of the season, would hitherto have been denied us.

On my arrival this morning at the Sault-Sainte Marie, I have found my two birch canoes and 16 rowers awaiting me, and have made an arrangement with the captain of the steamer to take us up, with men, boats, luggage, and all, to Isle Royale; and as the steamer is now starting I must conclude my Report.

Her Majesty's Secretary of State
for the Colonies.

And remain, &c.
(Signed) JOHN PALLISER.

No. 3.

No. 3.

COPY of REPORT from Captain PALLISER to HER MAJESTY'S
SECRETARY OF STATE FOR THE COLONIES.

Fort Garry, Hudson's Bay Company's Territories,
July 16, 1857.

(Received October 3, 1857.)

SIR,

IN continuation of my Report, dated Sault Sainte Marie, June 10, 1857, I have now the honour of acquainting you with our further progress.

Owing to the unusual lateness of the season, Lake Superior was crowded with floating ice, offering great difficulties even to a steamer, and, after consulting experienced persons, I determined to accept the further assistance of the steamer "Illinois," whose captain agreed, for the sum of \$800, to take up my two canoes on deck, 16 voyageurs, and ourselves across the lake, and leave us near Isle Royale, about eight hours' paddling distance from Fort William.

Although this might have appeared a large sum (*i.e.*, £11 5s.), yet subsequently I had reason to congratulate myself on adopting that course, for, shortly after, the men and canoes were taken up, we came on fields of ice, and the captain, after pushing his way for several miles, fell in with a schooner that warned him to return and try a course along the north shore of the lake.

At length, after deviating 70 miles from his course, he succeeded, and came in sight of the island at daybreak of the 12th June, four miles to the north-east.

We then launched, loaded, and started in our canoes, having avoided not only seven or eight days' journey, but also the risk of being stopped altogether by the ice.

We reached the mouth of the Kaministiquia at nightfall, and arrived at Fort William at 10 P.M. on the 12th June, where we learned that Sir George Simpson had only preceded us eleven days, having been eight days on the north shore of Lake Superior, where his canoe had been broken on the ice.

On Saturday, 13th June, we started, and encamped some miles from the fort, and on Sunday, the 14th, arrived at the mouth of the White Fish River. I halted here, and, according to my instructions, organized a party, consisting of myself and Dr. Hector, three voyageurs, and three Indians, and ascended the White Fish River. I chose these small birch canoes, on account of their drawing but very little water; they could merely carry two paddlers and one passenger each, while the third, with two paddlers, took the provisions for the party, consisting of eight people in all.

I can readily understand why the existence of this river has been denied, as its mouth could be easily passed unobserved by those only travelling in canoes on the Kaministoquiah, owing to its taking a sudden bend before flowing into that river, and therefore appearing much like a recess of the Kaministoquiah.

The White Fish River varies in breadth from 40 to 60 yards, and is 5 feet deep at its mouth; but useless for purposes of navigation, owing to the frequency of the rapids. We punted up a considerable portion of the stream at intervals, when the rapidity of the river prevented us from paddling. In the first day of our journey up the river, the barometer indicated a proximate ascent of 75 feet in 12 miles, and on the second day a further rise of 100 feet in six miles. Here a very large tree fell on one of the canoes, and dashed it to pieces, I myself narrowly escaping by jumping out of the way. The rain was very severe, and the men very much exposed, being obliged frequently to get out up to their middles in water to assist in bringing up the canoes.

Owing to the accident which befel our boat with the provisions, we were obliged to return the next day.

Dr. Hector and I started accordingly on foot at 6 A.M., June 14th, straight through thick woods, in the direction of the falls of the Kakabeka, distant by our calculation 27 miles, taking two Indians with us, and sending back the remaining canoes with the third Indian, and the three voyageurs to the camp at the mouth of the White Fish River, with directions for the whole party to go on to the falls of Kakibica, and meet us there.

On leaving the course of the White Fish River, we ascended a steep bank into a region of larch woods, and, contrary to our expectations from the previous reports, found no difficulty in pushing forward at the rate of $3\frac{1}{2}$ miles through the country intercepted between the White Fish and Kaministoquiah Rivers; and, if we could take our experience of that portion of the country for a fair average of the whole, I do not apprehend any difficulty in connecting, either by means of railroad or a common road, the country around Fort William with the south shore of Sturgeon Lake, but the accident which occurred to our boat and provisions took place before we reached the watershed which must necessarily exist between the head of White Fish River and the waters which flow into Lake Winnipeg; and therefore it still remains to be seen what amount of difficulty to overcome the watershed will present at that point, compared with that which it offers, both on the Old Portage Route and the Northern Portage Route, which we have followed.

All this time heavy rain fell with little intermission, and detained us for several days after we had arrived at the Kakabeka Falls.

On the 23d we reached the height of land, and next morning crossed the Savannah Portage into the Savannah River, and commenced the descent of the watershed towards Lake Winnipeg.

On the 1st July we arrived at Fort Frances on Lac la Pluie, and, while at breakfast in the fort, a large number of Indians formed a deputation, headed by their chiefs with their soldiers, and led by the old chief of the Lac la Pluie nation. It seems that they had heard a rumour of my arrival, and had organized this deputation for some time previously. This fact I would not have taken up your time by dwelling on, were it not for the high tone which the old chief took in his harangue, which contained in it more than the mere ordinary imagery with which they make speeches for the sake of obtaining presents.

He said, "I do not ask for presents although I am poor, and my people are hungry, but I know that you have come straight from the great country, and we know that no man from that country ever came to us and lied. I want you to declare to us truthfully what the great Queen of your country intends to do to us when she will take the country from the Fur Company's people. All around me I see the smoke of the white man to rise. The 'long knives,' (i.e. the Americans) are trading with our neighbours for their lands, and they are cheating them and deceiving them. Now, we will not sell or part with our lands."

It was of no use to try and cut him short by any assurances that I was not employed to treat for the sale of his lands; and I told him confidently that if he did not wish to

part with his lands, and also if he and his people behaved as always they had done, that is, quietly and peaceably, with the white faces, I would assure him that the Queen would never send soldiers to deprive them of their lands by force.

Here an Indian (not of their nation, but of a friendly neighbouring tribe) muttered to him in a low tone, "Make him put it into writing on a piece of paper; make him, I say; and now I have said it, for its nothing to me one way or the other, but I know the whites on the other side where we are, and I say make him put it into writing." But the orator said aside to him, "No, what he will say he will keep to." "Now," continued he aloud, "what is to become of us? we have no more animals; they are all gone, and without skins the Company will not give us goods from their store; and only for the little fish we take we would starve, and many of us do starve and die." I answered that they were to blame for not endeavouring to cultivate their lands and find other resources for maintaining themselves besides hunting. He answered, "There are none to show us, and we have no implements to do it with."

He then objected to Mons. Bourgeau collecting plants, and requested that Dr. Hector should not take away any mineral specimens as long as we were in his territories. He also begged that the great Queen might be made acquainted with their unhappy condition, and that she might know that his heart was grieved by reason of all those of his children who died by hunger. He asked me to promise that I would acquaint the great Queen of these things, and to see her myself.

But I satisfied him that I would write his words to the big men that were in the habit of giving good advice to the Queen, and so we parted good friends.

All this, insignificant as it may appear, was of some importance to us, as the chiefs, with their old leader and orator, were highly excited. There were upwards of 200 Indians inside the fort, 100 of whom were armed, and our party consisted of myself and interpreter, and my three companions, and the agent and storekeeper of the fort.

The conference lasted two and three quarter hours, in which period I heard and replied to five speeches, and the gentlemen in charge of the post seemed greatly relieved at the Indians quietly leaving the fort on the successful issue of the conference.

On the 5th July we camped on Sturgeon Lake, at the mouth of what has hitherto been called Sturgeon River, and, according to my instructions, I started with Dr. Hector to explore back again in a south-east direction towards the White Fish River.

We had not proceeded far, when what appeared merely a river turned out to be a passage to a very large lake.

We pushed across in an easterly direction, and searched the opposite shore for an outlet, found a very fine waterfall, and walked up the woods without much difficulty for about a mile and a half, when we came on another lake whose dimensions appeared not far inferior to those of the first. And from all I have seen, both immediately on the route and whenever I have deviated (which I have often on foot for hours while the men were resting or cooking), I have come to the conclusion that the whole country between the watershed and Sturgeon Lake is but a mass of lakes and islands. The traversing of this country can only be effected in winter by means of sledges and snow shoes when the lakes are frozen, and the underwood, the swamp, and fallen timber are filled up by the snow, over which there is then no difficulty in travelling on snow shoes; and as I was aware that this was not the proper season for carrying out the investigation, on account of the large staff of men, canoes, and provisions which I would have required, and the details of which (*i.e.* those connected with running a road through a woody, swampy, and lake country) would be far better carried out by a professional engineer with a sufficient staff of assistants and lumberers, the providing of which would perhaps more immediately be the duty of the Canadian than that of Her Majesty's Government at home. It is much to be regretted that the means of so many miles of deep and valuable water carriage should be rendered unavailable by so great a number of small, insignificant portages.

Many of these difficulties, however, are to be overcome by engineering, at but a trifling expense, and if ever the country becomes inhabited it will hereafter enjoy much facility for steam-boat communications.

On Wednesday July 8th we reached the Island Portage, the last on the route, whence there is uninterrupted communication by water all the way across Lake Winnipeg to Lower and Upper Fort Garry, and as far as Fort Pembina on the other side of the frontier.

We reached Lower Fort Garry on Saturday the 11th, rode to the English Protestant Church on Sunday, about four miles distant, and were much surprised to find a large attentive congregation of Scotch people and half-breeds of various shades of colour.

The summer here is very warm, and crops seem quite, by the rapidity of their growth now, to make up for the long dreary winter of this country. The resources of the

country are not half developed. The indolence of the people is truly wonderful, and seems even to have the effect of corrupting those who have arrived with previously active habits. Hunger and want do not seem a sufficient stimulus to arouse them to exertion. The Hudson's Bay Company do not import more than one quarter of the goods sufficient for the use of the settlement, their equipment having always been far short of what is required, and purchasers with means and produce are refused the articles they want on that account. The want of adventure and energy pervades all classes. There is no labouring class whose labour can be depended on for a day; they hunt during three months of the year, and beg, borrow, and starve during the remaining nine. Their grievances appear imaginary, and indolence the cause of all their trouble. This character is mainly that of the half-breeds. Of the Scotch there are many that do well, but would succeed far better if they could reckon on obtaining any regular labour. The only hold the Settlement has on the enlightened members of its society is the security of property here, and good laws, as compared to the insecurity on the American side. Should the American legislature obviate that difficulty, all the industrious and valuable portion of the population would soon flock over to the other side.

Thunder storms are of frequent occurrence here, and though apparently not severe, yet frequently fatal to human life. While I was writing the above, a flash of lightning has fallen on an Indian tent, and killed one man and three women. I found two of them fearfully burnt, but the remaining two, though quite dead, are seemingly untouched. I have myself frequently, on Lac la Pluie, and elsewhere on the route, observed the lightning to flash upwards from the earth to the impending cloud, when it often presents the appearance of a forked string of bright beads.

I purpose leaving this on Monday morning with Dr. Hector, Mr. Sullivan, and Monsr. Bourgeau and thirteen men, all well armed. We shall go as far as the frontier at Pembina, and thence along the boundary to Turtle Mountain, thence to Beaver Creek, and from thence right across to the elbow on the Lower Saskatchewan. My horses, about thirty in number, stand me an average of 20% each, and the men's wages at the rate of 40% per year. Traversing the Lower Saskatchewan is, I regret to say, not unattended with danger. Sir George Gore was reported as having been decoyed into a conference with the Sioux, about a year ago, and he and his party were robbed of their baggage, horses, clothes, arms, and ammunition; and he himself, without even a shirt, was obliged to take refuge at Fort Union, fortunately not too far away to enable them to reach alive.

I have the honour to enclose you my Secretary Mr. Sullivan's astronomical observations, and I have desired Dr. Hector to communicate his geological researches to Sir R. Murchison. Monsr. Bourgeau has been most successful in his botanical collections, and is preparing a case of Flora and seeds for Sir Wm. Hooker, which I trust will arrive safely in England before the end of October next.

I have endeavoured to embody as many of the principal incidents recorded in my journal as the short space in an official letter will permit, and I hope to have the honour of continuing this report as soon as I have reached my winter quarters at Fort Carlton.

I have, &c.

(Signed) JOHN PALLISER.

Her Majesty's Secretary of State
for the Colonies.

Enclosure in No. 3.

Locality.	Barometer.	Thermometer.	Chronometer Times.	Error on G.M.T.	Ind. Ex.	Observed Alts.	Observed Azs.	Longitudes.	Latitudes.	Variations.
Trembling Portage	29.1	61	d. h. m. s. June 21 3 3 31	+2 39.9	4 40+	94. 36 26 ☉	N. 103 53 E.	89 59 48 W.	48 31 5 N.	6 21 E.
On Kaminstiquia	28.9	56	" 21 8 50 46.5	2 39.9	4 40	95 4 52	N. 243 54 E.	89 58 10 W.	48 40 00	5 14 E.
In lat. 48° 45' N.	28.8	57	" 22 15 59	2 43.2	4 40	Varn. by hr. 4	N. 91 36 E.	89 53 0 W.	48 45	8 54 E.
In lat. 48° 55' N.	28.75	69	" 23 2 20 53	2 44.7	4 40	Ditto	N. 91 49 E.	89 53 48 W.	48 55	9 5 E.
Savannah Portage	28.62	84	" 25 2 0 45	2 49	4 40	72. 23 25 ☉	N. 88 35 E.	90 5 0 W.	48 53	6 53 E.
Perch Lake	28.44	81	" 27 12 17 22	2 54.5	4 40	30 30 10	N. 279 40 E.	91 12 0 W.	48 35	8 14 E.
In lat. 48° 27' N.	29.05	51	" 29 1 16 57	3 3.9	4 40	Varn. by hr. 4	N. 75 30 E.	92 30 0 W.	48 27	9 53 E.
Fort Francis	29.0	85	July 1 4 19 96	3 5	4 40	111 1 38 ☉	N. 118 15 E.	93 30 0 W.	48 36	9 31 E.
In lat. 48° 50' N.	29.45	83	" 3 3 34 32	3 12	5 51	95 25. 11	N. 101 00 E.	93 58 0 W.	48 50	11 20 E.
In lat. 49° 26' N.	29.39	85	" 4 3 20 9	3 14	5 51	89 6 6	N. 96 35 E.	94 48 0 W.	49 26	10 17 E.
In lat. 50° 15' N.	-	-	" 6 3 2 29	3 16	5 51	84 29 16	N. 91 25 E.	95 17 19 W.	50 15	15 7 E.
Lake Winnipeg	-	-	" 10 10 9 3	3 28	5 51	74 26 40	N. 244 49 E.	96 34 0 W.	50 33 48	14 41 E.
Ditto	-	-	" 11 2 29 0	3 30	5 2+	73 33 3	N. 84 43 E.	96 30 25 W.	50 23	14 9 E.

N.B. The Tabulated Longitudes are not deduced from the Tabulated Altitudes—the Variations only.

JOHN W. SULLIVAN,
Secretary to the Expedition.Approved as correct,
JOHN FALLISER,
July 17, 1857.

Locality.	Barometer.	Thermometer.	Chronometer Times.	Error on G.M.T.	Ind. Er.	Mean of Observed Alts.	Latitude.	Longitude.	Remarks.
Fort William	29.5	64	d. h. m. s. June 13 1 41 18.6	+2 20.3	4 40+	68 41 20 ☉	48 24 10 N.	89 26 10 W.	All the results are deduced from a mean of five observations.
Trembling Portage	29.1	61	" 21 2 44 55.4	2 39.9	"	88 43 14	48 31 5	89 59 48	
Dog Portage, W.E.	28.8	57	" 22 2 29 17.2	2 42.3	"	83 37 24	48 46 11	89 54 45	W.E. = West End.
Dog River, R.B.	28.75	69	" 23 2 14 14.5	2 44.7	"	78 28 12	48 56 0	89 54 48	R.B. = Right Bank.
Savannah Portage	28.62	84	" 25 2 4 27.1	2 49.6	"	74 41 8	48 53 2	90 13 46	L.B. = Left Bank.
Barrier Portage	28.85	79	" 26 10 31 23	2 52	"	63 59 56	48 45 58	90 51 24	S.S. = South Shore.
French Portage	28.39	79	" 27 4 1 36.6	2 54	"	109 17 10	48 40 0	91 11 30	
Camp Portage	28.37	81	" 29 13 21 47	3 1.5	"	11 48 20	48 15 57	92 28 28	
In lat. 48° 27' 5" N.	28.4	94	" 30 1 9 54.5	3 3.9	"	53 10 20	48 27 5	92 30 4	
Fort Francis	28.41	73	July 1 11 52 3.8	3 3.4	"	40 57 0	48 36 15	93 33 33	
Rainy River, L.B.	28.5	86	" 3 3 40 27	3 9.3	5 51.5+	99 7 40	48 50 0	94 14 19	
Portage de Bois	29.06	86	" 4 2 29 20	3 11.7	"	75 30 48	49 26 8	94 48 7	
Winnipeg River	29.0	89	" 5 2 58 49.8	3 14.1	"	84 28 40	49 55 0	94 45 30	
Ditto R.B.	28.95	92	" 6 2 52 35.6	3 16.1	"	81 26 3	50 15 6	95 17 19	
Lake Winnipeg, S.S.	29.0	93	" 11 2 24 30.7	+10 55	5 2+	72 26 0	50 22 58	96 30 25	

Approved as correct,
JOHN FALLISER,
July 17, 1857.

JOHN WM. SULLIVAN,
Secretary to the Expedition.

COPY of a REPORT from Captain PALLISER to HER MAJESTY'S
SECRETARY OF STATE FOR THE COLONIES.

Fort Pembina, Hudson's Bay Company's Territories,
July 27, 1857.

SIR,

(Received October 3, 1857.)

IN continuation of my Report of the 16th July, I have the honour to inform you of the departure of the Expedition from Fort Garry to Fort Pembina, on the 21st instant.

I have now engaged twelve men, thirty horses, two small waggons, and five carts. In consequence of the absence of buffalo in this portion of the country, I am obliged to carry along with me a considerable quantity of provisions to last until we arrive sufficiently far to the westward to fall in with these animals. For this purpose I found the small heavy carts of the country not sufficient, and, contrary to the advice and prejudices of the people, bought two small American waggons, and have found them most efficient.

I was not disappointed with the class and condition of the horses obtained for me by the Hudson's Bay Company, as I have all along been aware that the half-breeds of Red River have taken their best horses to the summer buffalo hunt.

I have, in order to save as much extra travelling as possible to the horses, sent on four men, with four carts and ten horses, straight to Beaver Creek, with orders to await our arrival in that quarter; while Dr. Hector, Mr. Sullivan, and myself take the route thither, via Pembina and Turtle Mountain. This arrangement will serve to recruit my horses, whose pasture hitherto has not been good.

On leaving Fort Garry we crossed the river Assineboine, and proceeded up the Red River for nine or ten miles, in a course a little east of south, through copse and light timber. We crossed the river Sall nine miles from Fort Garry, a river about twenty-five yards wide, but not put down on the maps. Shortly after this we emerged on the open prairie over a well-defined road, indicating a far greater amount of traffic than I had expected to find.

Owing to the peculiar distribution of the wood, which consists principally of fine oak trees, and is confined principally to the right bank of the river, the tortuous course of which is very distinctly marked by jutting promontories, called by the people "poirts," I observed that the agricultural resources of the country were not merely confined to Red River Settlement, for the country through which we passed assumed fully equal and in some places even superior advantages, being more elevated above the river. I had an opportunity of noting the nature of the soil, where a settler was digging for marl about six feet deep, and again at Pembina, where I had a special examination made. It consists of about one foot of black vegetable mould resting on a free clay loam of a light grey colour, but very deficient of sand.

The banks of the rivers in this country are composed of remarkably tenacious clay mud, rendering access to them very difficult, and great care is required in passing a cart or waggon across. On 22d we crossed Rivière qui Grate, situated thirty-eight miles south of Fort Garry: this river, as well as the Rivière Sall, we passed in pontoons. The ferryman here was a very intelligent American, who had recently arrived in the country by a route from the Lake of the Woods, following the course of Reed Grass River.

He described the first twenty-five miles west of the Lake of the Woods as being flat and swampy; he partly paddled and partly dragged his canoe over a slightly rising country until he reached Reed Grass Lake, out of which a river of the same name flows. The country about the head waters of this river is swampy, but the lower half of its course, according to his account, flows through a dry and finely wooded country; but he described the river as shallow and swift, only fit for very small canoes.

I observed large pieces of driftwood scattered about the higher spots of the prairie, indicating the extent to which the whole country is flooded in spring. By measurement, I ascertained that last spring the water rose thirty-five feet above the present level of the stream, and it is by no means unusual for the flood to reach ten feet higher. Opposite Fort Pembina the river is about eighty yards wide and twelve feet deep; in dry seasons it falls five feet lower. From Mr. Iddings (an American Civil Engineer, whose name will appear in this Despatch), I ascertained that the river is fifteen feet deep 200 miles further up, but there its width is reduced to ninety feet, and the frequent occurrence of sharp bends in its course would make it difficult to ascend in steamboats.

The mouth of Pembina River, which flows from the west into Red River, is situated about two miles south of the boundary line. Upon this river, at a distance of about twenty-five miles from this, I am informed that there is a thriving American town called San Josef's, which, owing to its recent establishment, is not yet recognized in our maps.

On Friday, July 24th (the day after my arrival here), my Secretary Mr. Sullivan and I took the meridian altitudes of the sun, in order to find the locus of the 49th degree of north latitude, and to determine the direction of the Boundary line.

We were shown at the same time a post driven into the earth to indicate a similar observation taken by Mr. Nicolay, an American gentleman, well known in the American scientific world.

On this occasion I availed myself of the valuable assistance of Mr. Iddings, the gentleman to whom I have alluded above, and who is commissioned to lay out lots of land from the frontier line southward, purchased by an American Land Company; and this gentleman, with my Secretary Mr. Sullivan, placed another post at about 300 yards in the direction of true west, making the necessary allowance for the variation of the compass here, which Mr. Sullivan found to be 14° E.

Mr. Iddings informed me that the Land Company by whom he is employed intend to build a town here, and establish a railway station, about two miles distant from the posts whose positions we have established. As yet the place is but a wild waste. The Hudson's Bay Company's Fort, where we have been residing for the last two or three days, is a very small shabby establishment, and the American one, situated about two miles on the other side of our present line, is still smaller and more wretched in appearance.

It, however, professes to be a Post Office, and carries a mail, said to be a monthly one, from St. Paul's; but as the Postmaster is away at present, and left the place under care of an Indian woman, who speaks no other language but her own; consequently I cannot form very accurate ideas as to the safety of any letters committed to its care. Still however, I am induced to forward these by the assurance of an intelligent half-breed, who told me that the Post Office here is "a very lucky one."

Enclosed is a Note of the Observations made on the direction of the Boundary line, drawn up and signed by myself and the two gentlemen engaged in the survey.

I have, &c.

(Signed) JOHN PALLISER, Captain,
Commanding the North American Exploring Expedition.

Enclosure.

Encl. in
No. 4.

Enclosure in No. 4.

NOTE of OBSERVATIONS at PEMBINA by Captain PALLISER, Mr. IDDINGS (U.S.), and Mr. SULLIVAN.

AN Observation taken at the above place by Mr. Nicolay in 1848-49 places a post in latitude $49^{\circ} 0' 0''$ N.

An Observation taken by Capt. Palliser places the same post in latitude $48^{\circ} 59' 49''$ N.

Mr. Iddings (U.S. Civil Engineer), and my Secretary Mr. Sullivan, after ascertaining the variation of the compass at place, erected a second post, distant from the first 270 yards due east thus determining the direction of the Boundary line.

JOHN PALLISER, Captain,
Commanding British North American Expedition.
C. W. IDDINGS, C. E. (U.S.)
JOHN SULLIVAN, Secretary,
and Astron. Assistant to the Expedition.

No. 5.

No. 5.

COPY of a REPORT from Captain PALLISER to HER MAJESTY'S
SECRETARY OF STATE FOR THE COLONIES.

Montreal, Canada East, December 8, 1857.

SIR,

(Received December 29, 1857.)

IN continuation of my Report of the 27th July 1857, I have the honour to inform you of the further progress of the North British American Exploring Expedition.

On September the 28th I arrived at San Joseph, an American town, about seven miles south of the British frontier line; the population consists of British as well as American half-breeds, whose chief dependence is on the proceeds of the buffalo hunt, and while the more youthful part of the male population are away on the hunt, the then defenceless inhabitants are subject to the inroads of the Sioux Indians. These Indians last year attacked that settlement, stole almost all the horses, and shot a woman and the

schoolmaster; indeed hardly a year passes over without some similar depredations. Although that bend of the Pembina River on which St. Joseph is situated is inside the United States territory, yet the greater part of the river's course is through the British dominions. It is an important river, and may hereafter prove valuable as affording facilities for navigation. I have therefore had its course correctly laid down in our charts.

On the 4th August we reached Turtle Mountain, a hill rising out of the prairie to about three hundred feet; it is thirty miles long, ten broad. This hill is one of a series that we have since traced scattered irregularly in a line from S.E. to N.W. The boundary line passes through the summit of this mountain, throwing the "Souris" or Mouse River into the British possessions. This river has hitherto been wrongly laid down in all maps, and I have therefore also paid strict attention that its course should be carefully laid down in our charts.

August 15th. We reached Fort Ellice on Beaver Creek. Here I found the men I had sent direct from Fort Garry with the ten horses, and as these had now more than a week's rest, I took these ten horses on an expedition to "La Roche Percée," leaving the horses that had been hitherto travelling with myself to recruit.

Proceeding on a S.W. course from Fort Ellice, we arrived on the 18th of August at Moose Mountain, one of the chain of hills above mentioned; it, like the Turtle Mountain, is covered with dense woods, lakes, and swamps.

On the 20th August we arrived again on the Mouse or "Souris" River, and here Dr. Hector first discovered coal of a very fair quality. From this point of the Mouse River an hour's ride brought us to the "Roche Percée;" a singular appearance is here produced on the rocks and stones by combined action of the atmosphere and water; the layers of sand and clay forming these being unequal in hardness, are worn accordingly in grotesque shapes, affording more astonishment to the Indians and half-breeds visiting the spot than interest to the geologist on a more close examination.

Here I was visited by a large number of Stone Indians, celebrated as the greatest horse thieves in the country. However, I concealed all apprehension for my horses. I also discovered that meat was a very scarce article among them, as they had not fallen in with buffalo for many days. I had, however, been fortunate enough to kill two bulls that morning, and secured their good offices and the safety of my horses by giving them the meat, inviting them to cook and prepare their own feast, to which I added some tea, sugar, and flour, desiring them in return to guard my horses all night, which injunction they regarded as a compliment, and faithfully performed.

The following day we returned, and reached Fort Ellice on the 25th of August.

On examining the horses I had left behind at this post when I started for "Roche Percée," I found them not sufficiently recruited to proceed westward to the Elbow. I therefore determined to wait a few days longer. I likewise found that my guide and interpreter was so frightened at the prospect of entering the Blackfoot country, that he gave me very false interpretation as to the facilities of the route I intended (according to my instructions) to adopt. I therefore started a messenger to Mr. Christie, the chief officer of the Hudson's Bay Company, requesting the services of Mr. McKay, the officer in charge of Fort Ellice, as an interpreter to accompany me on the expedition. Mr. Christie on receiving my letter rode three day's journey to meet me at Fort Ellice, and brought with him a gentleman to put in Mr. McKay's place; thereby putting the valuable services of the latter at my disposal. In the meantime on the 7th of September, finding my horses sufficiently rested to resume operations, I started the Expedition under Dr. Hector for the Qui Appelle Lakes, and remained behind at Fort Ellice until I should see or hear from Mr. Christie, whose subsequent arrival on September 9th, set Mr. McKay at liberty, and after accounts were made up and transferred, I started on horseback, accompanied by McKay and two of my men, who had remained behind for the purpose, and overtook the Expedition in three days at the Qui Appelle Lakes, about 135 miles west of Fort Ellice.

On Sunday, September 13th, we remained at the Qui Appelle Lakes. Here the Hudson's Bay Company have a small trading post, the most western fort in the territory, and there we found a large camp of Crees arrived for trading. I sent for Mr. Pratt, the missionary, requesting him to come and pay us a visit. He is a pure Cree Indian, educated at Red River. He reports the Crees as beginning to apprehend scarcity of buffalo, and many are most anxious to try agriculture. He thinks that if they had agricultural implements, such as spades, hoes, and ploughs, they certainly would commence operations. This opinion I found pretty general among the people of the Hudson's Bay Company, and I am persuaded much good could be done by importing the simpler kinds of agricultural implements. Pratt has set the Indians an excellent example himself, and

grows capital Indian corn, barley, and potatoes. The Qui Appelle Lakes may be considered ~~the most western part of the territory east of the Rocky Mountains, to which the Hudson's Bay Company trade~~; westward of this I may say is unknown, and the whole country in this latitude is untravelled by the white man.

Among the Indians that had come to trade was a man Mr. M'Kay was acquainted with. This man was a remarkable exception to the generality of Indians: they call him "the Peacemaker," and twice within the last two or three years he pushed his way alone into the Blackfoot country, and walked into the enemy's camp unarmed, with the peace-pipe in his hand, exhorting them to peace, and offering them the alternative of killing him. The result on each occasion was a treaty of peace to the Crees and a present of horses to the Peacemaker. I engaged this Indian to guide us to the Elbow.

On September the 14th we started from Qui Appelle Lakes for the Elbow on the south branch of the Saskatchewan, sometimes called the Bow River. On September 16th we again camped on Mouse or Souris River, at a tributary called by the Indians Moose Jaw Creek, in longitude 106°; up to this point in our journey we had suffered no inconvenience from want either of wood or water; here, however, our guide, the Peacemaker, advised us to bring wood along in our carts, as we should see no more until we came to the Saskatchewan, which we first came in sight of at sunset on the 21st of September.

We were now in the heart of the buffalo country. This region may be called a buffalo preserve, being the battle-ground between the Crees and Blackfeet, where none go to hunt for fear of meeting enemies, and where those who go to war abstain from hunting. The whole region as far as the eye could reach was covered with buffalo, in bands varying from hundreds to thousands. So vast were the herds that I began to have serious apprehensions for my horses, as the grass was eaten to the earth, as if the plain had been devastated by locusts. However, the timber on the small tributaries of the river kept off the buffalo, and so a little grass was obtained for the horses, for the buffalo shuns the timber until mid-winter.

At the Elbow I found a large tributary flowing from the east into the Saskatchewan, and I despatched Dr. Hector with one or two men to trace the course of this river, which I find flows from the most western of the chain of "Qui Appelle" Lakes, being navigable to large boats the whole way. Hence I have been able to ascertain that there exists a valuable water communication between the South Saskatchewan and Red River, and that a good sized boat, and even perhaps a small steamer, might descend from the South Saskatchewan, ascend the West Qui Appelle River, cross the Qui Appelle Lakes, and then descend the Qui Appelle into Red River.

After the Doctor's return from exploring the western "Qui Appelle" we commenced our ascent from the Elbow, and reached the 109° meridian of longitude on the 28th of September. This magnificent river rivals the Missouri in size and volume, and even at this (the lowest state of water during the whole year) was navigable for craft of any size, as I found by sad experience, having been so unfortunate as to lose one of my waggons in the channel of the river at a depth of sixteen feet, where I subsequently crossed it. All particulars of this river, its timber, capabilities, &c., will be found in my journal, which I hope to have the honour of forwarding to England next spring. The 109° of longitude is the furthest point to the westward that I have this season explored. At this point I crossed the river to the north side, and started on a north-east course for Carlton, my winter quarters, where we arrived on the 8th of October.

I have endeavoured to conduct the Expedition with the greatest economy, and feel happy to say that I have as yet no apprehension of the grant for 3,000*l.* for the first year ending March 31st, 1858, being overdrawn, although I received and obeyed my orders to adopt the canoe route in June last, a most expensive one, and one for which I never estimated. Also a large amount for instruments (per Lieut. Blackiston) over which I have had no control. I have now paid all the men engaged, and discharged them with the exception of four, who remain at Carlton through the winter, to hunt, cook, chop, and look after the horses, and one at Red River to accompany me on my return early next spring, before the breaking up of the ice. I hold now for Her Majesty's Government forty horses, together with carts, harness, arms, instruments, &c., to the value of 1,000*l.* and upwards. The horses, owing to the great care and watchfulness which has been exercised towards them, will be far more serviceable next season than they were the last one, owing to the wretched condition in which I was obliged to receive them. Three days after the arrival of the Expedition at Fort Carlton, and as soon as I had paid off the men and made further necessary arrangements for sending them home to Red River, also as soon as I had arranged matters for the gentlemen and the men who were to winter there, I started on hired horses with Mr. M'Kay for Canada, finding it necessary to see and confer with Sir George Simpson, for the purposes and objects of the Expedition, also in order to put

~~myself in communication with the Colonial Office at home, with a view of receiving further instructions, to which I shall beg leave to draw your attention at the conclusion of this letter.~~

I started from Carlton (Upper Saskatchewan), October 11th; reached Touchwood Hills October 15th; Fort Pelly, October 18th; Fort Ellice, October 23d; and on the 1st of November arrived at Red River. This portion of my journey was very cold, accompanied with snow, almost every day, yet not sufficient to delay me or cause me much inconvenience. At Red River I found very great difficulty in obtaining horses and a guide to Crow Wing, Minnesota Territory, but at length succeeded for the sum of 65*l*. in obtaining the services of a half-breed, named Robert Tate, and his horses, to take me there, a distance of about five hundred and twenty miles. For this sum I was supplied with a horse to ride, besides the horses necessary to carry our baggage, bedding, and provisions. Unfortunately, however, my horse was killed at Pembina, and I had to go on foot about four hundred and fifty miles of the way: the snow, however, was so deep, and the weather so cold, that it did not much signify, and we arrived at Crow Wing on the 19th of November.

From Crow Wing there is stage conveyance to St. Paul's and Prairie "Le Chien," partly by coach, and principally by waggons and sleighs. At Prairie "Le Chien" is the railway terminus, from which I proceeded, via Chicago and Detroit, to Montreal.

On my arrival here, I lost no time in conferring with Sir George Simpson, and settling the accounts of the Expedition for this year. I have therefore, according to my instructions, drawn on Her Majesty's Paymaster-General for 2,000*l*., thus leaving a balance of 350*l*. to meet a few small accounts not yet received at Lachine from the more remote posts of the Hudson's Bay Territory, also the stores from York factory for winter clothing and consumption sent by boat this summer to Carlton.

While I was at Red River on my way to this, I made my arrangements for proceeding next spring with the Expedition by engaging twenty men, and ordering them to proceed on the 10th of March 1858, with a sufficient number of dog sleighs to convey their provisions up to Carlton, in order that all may be in readiness for as early a start as the season will permit. My course will be in the first instance to visit Eagle Hills, and thence to strike for the south branch of the Saskatchewan, and renew my explorations at that point where I left off at the end of September. I regret that I am obliged to engage so many men, as their pay and small rations will increase the expense of the Expedition; but with a smaller number it would be the height of imprudence to venture into the south-western part of the Blackfeet and Pegan country. A smaller number would only invite the Indians to attempts on the horses. It is true I have hitherto only travelled with thirteen men, but the Indian camps I have met (with one exception at Roche Percée) were small ones, but next year the camps I shall fall in with are much larger, and to meet this I must increase the number of my men to thirty in all, viz., four men at Carlton; one man at Red River still under pay; five at Carlton to commence pay on April 1st, 1858, at 15*l*. for six months; and 20 from Red River to commence pay March 10th 1858, at 20*l*. for six months. After this dangerous country shall have been traversed, much fewer men will suffice, by returning to the settlement on the Hudson's Bay Company's beaten track via Edmonton, but the country the Expedition will have to traverse next year in order to fulfil its objects will be so great that it would be impossible to fulfil my orders of sending the Expedition back in time to reach St. Paul's in the fall of 1858.

Under these circumstances, I think it of great importance that Her Majesty's Government should communicate to me further orders; and I should suggest that my services be taken for another season, and that the Expedition should winter in the country between the forks of the Red Deer River, and the Rocky Mountains in the winter of 1858. Thus all the objects in investigating and exploring the country, for both physical and scientific purposes, would be fully attained.

I intend to leave this for New York immediately, there to await the favour of an answer to this letter, and whether it will be the pleasure of Her Majesty's Government to extend the time granted for the Expedition until the fall of 1859.

Should Her Majesty's Government wish to consult with me in person, there would be sufficient time to convey their intention to do so to New York, and for me to repair to the Colonial Office, London, and afterwards return in sufficient time to reach Fort Carlton in spring.

All the chief expenses of the Expedition have been incurred; viz., a most expensive canoe route, also arms, provisions, &c., and finally a large number of horses bought; all of which expenses will have to be undergone for the next Expedition which will have to succeed mine, in the event of our being recalled in 1858, with our explorations

incomplete, owing to too short a space of time for examining so large a territory; add to this the fact, that the mineral resources of the British Rocky Mountain territory are utterly unknown, and the assurances of more than one gentleman in the service of the Hudson's Bay Company of having found specimens of nikel, lead, and gold in that region.

My address will be, St. Nicholas Hotel, New York, U.S.; and anxiously awaiting your further commands,

Her Majesty's Secretary of State
for the Colonies.

I remain, &c.

(Signed) JOHN PALLISER, Captain,
Commanding North British American
Exploring Expedition.

No. 6.

No. 6.

COPY of a REPORT from Captain PALLISER to HER MAJESTY'S
SECRETARY OF STATE FOR THE COLONIES.

Fort Garry, Red River, May 3, 1858.

SIR,

(Received June 26, 1858.)

I HAVE the honour to report my arrival at this post, on my way to join the Expedition, and recommence my explorations this year from Fort Carlton.

I shall still be obliged to wait for some days until the grass is sufficiently forward to enable me to proceed on horseback.

Although the snow has disappeared, yet, owing to the cold northerly winds that now prevail, the grass is now quite as backward as it usually is at this period of the year, although the winter has been an extraordinarily mild one; I hope, however, that I may be able to start on or about the 10th instant.

I accomplished my voyage from Crow Wing (Minnesota territory) to this place in a month, in a canoe, assisted by two half-breeds. We punted up the Crow Wing and Leaf Rivers, carried the canoe across the height of land from Leaf Lake to Ottetail Lake, but in attempting to cross the latter to the south shore we narrowly escaped being crushed in the ice; however we extricated ourselves, and were consequently obliged to extend our portage along the eastern shore round to the mouth of Ottetail River (the principal head of Red River). Down this river we ran all the rapids but one, making there quarter mile portage, joined the main stream of Red River at "Bois des Sioux," and came down to Fort Garry.

I have the honour to enclose you Lieutenant Blakiston's letter on the subject of the Hudson's Bay and York Factory voyage up to Carlton on the Saskatchewan; likewise Dr. Hector's Geological Report of 1857, which I will thank you to be so kind as to place in the hands of Sir Roderick Murchison.

I have received an English translation of Mons. Bourgeau's Report of the Botany and Flora of the country, which I should likewise have had the honour of forwarding to you, but, on reading the document, I find it so full of mistakes that it was attempted by an incompetent person. I therefore prefer deferring its transmission until after my arrival at Carlton, when I shall forward Mons. Bourgeau's Report in the original, with a request at the same time to have it placed in the hands of Sir William Hooker.

I have likewise received the map of the country, copied out by Lieut. Blakiston from the detached charts we ourselves made on the route. Unfortunately he made but one copy, and as I have not the means here of making a copy for myself, I will likewise defer forwarding it until after my arrival at Carlton.

I have the honour of forwarding the Astronomical Observations enclosed in a letter from my Secretary, Mr. Sullivan.

I have, &c.

(Signed) JOHN PALLISER, Captain,
Commanding North British American
Exploring Expedition.

P.S.—As almost the whole of my recent voyage has been through United States territory, I have not intruded a more detailed account on your attention; and I only wish further to observe, that my descent of the whole of the Red River from its principal source, has enabled me to judge of its great facilities for Steam Boat Navigation.

Her Majesty's Secretary of State
for the Colonies.

J. P.

Enclosure 1. in No. 6.

Encl. 1. in
No. 6.

SIR,
Fort Carlton, Saskatchewan River, 3d January, 1858.
As the subject of a communication between Red River Settlement and some civilized portion of the British Dominions is beginning to attract some amount of public attention, and as two indifferent routes are at present in use, one of which, namely, that from Canada, via Lake Superior, Rainy Lake, and the Lake of the Woods, you have this last season traversed, and will no doubt have made a report on the same, while during the same season I have passed the other, namely, from England, via York Factory, on Hudson's Bay, and Lake Winnipeg, I have the honour to lay before you my observations on the same for the information of Her Majesty's Government.

Description of Boats used in River Navigation.

In the first place, the mode of transporting passengers and goods between York Factory, Hudson's Bay, and Red River, which is at present, and has been for many years in use, is by means of large wooden boats built in the country, and well adapted for this kind of navigation. Each boat is of the following construction:—Length of keel 30 feet, over all 42 feet, which gives considerable shear equally to both stem and stern-post; breadth of beam 9 feet, sharp at both ends, depth inside 3 feet, and when loaded with 70 "pieces" (about 56 cwt.), besides the crew, oars, sail, mast, &c. draws two feet of water; it is steered by means of a long sweep passing through a ring made fast to the stern-post, except under sail when a rudder is shipped.

Voyages.

Each boat is manned by one steersman, one bowsman, and six or seven middlemen, who, mostly half breeds of French-Canadian or British descent, labour in the service of the Hudson's Bay Company for very moderate wages; their food, however, which consists of "pemmican" and flour, being supplied by the Company, as much as they have need of; in fact, were it not that they have plenty of good working food, they certainly could not continue this labourious work.

Up-passage.—Description of the Route.

The spring floods having subsided, the upward journey is performed as follows:—Leaving York Factory, which is situated on the left bank of Hayes River, five miles above its mouth, it is possible with a fair wind to sail about six miles to the head of the tide, at which place poles and the tracking line are obliged to be used for the purpose of passing some shoal places; from this sailing or "tracking" (hauling the boat in the manner of a canal barge by a line with four men walking on shore), with occasional poling over shoal places, is continued for a couple of days, after which the continual bends of the river and the strength of the current prevent the use of the sail, the mast, a rough pole, is therefore thrown overboard, and tracking with occasional poling is continued until the Rock Portage is reached, 124 miles above York Factory.

Work of Men.

Tracking is hard work for the voyagers, they take it turn about, an hour and a half at a time, in fact this river work, to say nothing of the "carrying" at the portages where many are injured, is very laborious and trying, particularly considering the fact of their being almost continually in wet clothes, from the necessity of frequently jumping into the water for the purpose of lifting the boat over stones, and their having to "track" over all sorts of ground under the high alluvial banks, often where scarcely foothold can be obtained.

Time occupied.—Nature of the Country.

This 124 miles of river, in my case, travelling with a brigade of six boats, lightly loaded, namely, with 50 pieces, was accomplished in six days. The river runs in a deep channel through alluvial soil, where not a piece of rock is seen, save the boulders in the bed of the river; from this first impediment westward to Lake Winnipeg the geological formation is primitive, the rock, which is nearly always at the surface, being granite and schist, and the whole country being but little elevated above the water.

Description of the Route.

Portage after portage, with occasional intervening lakes, succeed one another in rapid succession, over some of which the boats have to be carried, but at others hauled up the rapids by ropes, and the cargoes carried over land; suffice to say, that in the next 40 miles 20 portages are made, taking five days. After this two lakes of considerable size, Knee and Holey Lakes, are passed with four portages between them, soon after which the River Wepinapis narrows so much that the oars sometimes touch granite rock on each side, which rises vertically to a considerable height. Before emerging from this narrow gorge which continues for some miles, some very bad rapids have to be surmounted, and again before arriving at White-water Lake a portage for cargoes and boats of two-thirds of a mile has to be made, in order to avoid the White Falls. The end of a narrow lake is within a few yards of the source of the Echiamamis, a small stream whose waters flow to the westward; when sufficient water is only kept for the passage of boats by two dams six miles apart, these were formerly the work of beavers, but are now kept up by the passing boats. At the passage of a boat a portion is pulled away, the boats run through, and it is again shut securely. This stream, which on account of dams has little or no current, is for the most part through marsh, and so narrow that the Willows nearly meet over head, and the boat sometimes touches the bank on each side. At a distance of 358 miles from Hudson's Bay, Lea River is entered, when, by making the last of the 35 portages, and pulling against stream, Norway House, a post of the Hudson's Bay Company is reached, from which to Lake Winnipeg is but 20 miles without rapids.

Up-passage, Distance, and Time.

Thus, from York Factory to Norway House, a distance of 400 miles, is accomplished only after laborious work for three weeks. The time for the passage across Lake Winnipeg to Red River, 300

miles, depending entirely on the wind, may be taken on an average at seven days; making the entire distance from York Factory, Hudson's Bay, to Red River Settlement, 700 miles, in four weeks on the upward passage.

Down Passage.

The passage down stream from Norway House to York Factory, being accomplished in nine days, making about half a dozen portages, at three of which the boat is carried over, one being the two-thirds of a mile portage, all the other rapids being "run," not, however, without considerable risk, makes the passage from Red River to York Factory sixteen days.

Entire Passage.

Thus to go to and from Red River to Hudson's Bay without stoppages, is about seven weeks.

Another Route.

The outlet of the waters which are collected in Lake Winnipeg from the Saskatchewan, Swan River, Red River, &c. is from the north end of the Lake by Nelson River, which flows into Hudson's Bay at the mouth of Hayes River; but the falls and rapids are said to be so very heavy on this river, besides its being the longer route, that it is now never used.

Impossibility of Improvement for Steamers.

It has been proposed to improve the former route in order to allow of the passage of steamers, this however from the foregoing description will be seen to be impossible: for, if by cutting through solid granite and swamp and the construction of locks, the portages could be avoided and the smaller rivers widened, yet in the lower rivers the want of water could only be overcome by dredging, which operation would be entirely destroyed by the spring floods; and I think that it would be the opinion of any observing person passing through this route, that it would be impossible so to improve it as to allow of the navigation of anything larger than the boats (previously described) at present in use; and certain it is, that the future produce of the vast western plains could never be transported in this manner.

Hudson's Bay.

But were a route practicable there exists a consideration, which is above all others; namely, that from the outlet of Hudson's Bay being so far north, and the amount of ice in the bay itself, vessels cannot remain more than six weeks out of the whole year at York Factory, with a chance of afterwards being able to make their way out again to the Atlantic.

Natural Outlet.—Land Route proposed.

No doubt the natural outlet of this great western district is across an easy country to the water of the Mississippi and Missouri, which if first established the West is lost to Britain. It behoves us, therefore, to establish a route through our own territory, for the encouragement of emigration to, and the transport of the future produce from Red River and the great Western Plains to Canada. Now, as the water route from Lake Superior to Red River which you have traversed is of a still more amphibious nature than the more northern one described in this report it seems natural that we should look for a land route; I would therefore suggest a search for such a one, considerably to the north of the eastern part of the canoe route, namely, from a port on the north shore of Lake Superior crossing to the north end of the Lake of the Woods, which, as well as being quite as convenient for the lake navigation by steamers, would be on the line of a continuous railway from other portions of Canada and the United States; besides being much more preferable in a military point of view, than a route near the boundary line.

Means of Transport.

Steamers will no doubt navigate Lake Winnipeg and Red River, but the Saskatchewan being distributed at its mouth by a large rapid, and at other places by minor ones, besides the upper part containing numerous shifting sand bars, will likely be little used for navigation, particularly on account of the very level nature of the country westward from Red River and Lake Winnipeg, so suitable to the formation of Railways, which I doubt not will be the first means of transport on a large scale on these plains.

Postal Communication through United States.

At present there exists no postal communication between Canada and Red River except through the United States.

I have, &c.
(Signed).

John Palliser, Esq.,
&c. &c.

THOMAS BLAKISTON,
Lieut. R. Artillery.

P.S.—By the arrival of the packet, I hear that the Canadian Government having granted a sum of 5,000*l.* for the establishment of a route between Lake Superior and Red River: an engineering party is at present employed in laying out a road from the Lake of the Woods to the settlement of Red River, to form the western section of the route.

29th January, 1858.

T.B., Lieut. R.A.

Enclosure 2. in No. 6.

Encl. 2. in
No. 6.

Fort Carlton, Hudson's Bay Territories,

December 12, 1857.

SIR,

In compliance with your desire I have drawn up a general report, embodying the principal geological results of the exploratory journey made during the past season, in anticipation of a more detailed report to be completed during the leisure of the winter.

This report I have the honour of communicating herewith.

I have, &c.

(Signed) JAMES HECTOR.

To John Palliser, Esq., Commander of the North
British Exploring Expedition.

Enclosure 3. in No. 6.

Encl. 3. in
No. 6.

FIRST GENERAL REPORT on the GEOLOGY of the COUNTRY examined by the Expedition under the command of John Palliser, Esq., during the Season of 1857.

THE journey made by the Expedition during the first season has embraced two very different methods of travelling, marking regions of distinct geological structure and physical appearance. The first of these is the canoe route from Lake Superior to Lake Winnipeg; the second, the journey across the plains from Fort Garry to Fort Carlton.

The general structural features of the country travelled over on the canoe route, so far as they can be learned from a single line of traverse, have already been well described by Mr. Keating, Sir John Richardson, Dr. Bigsby, and others, but from the complicated relations of the rocks of which it is composed, no detailed observation can be of any value until they are extended in every direction by means of an elaborate topographical and geological survey.

The whole of this district is occupied by a primitive axis, the intermediate primitive belt of Sir J. Richardson, which is composed of gneiss, mica schist, and other metamorphic rocks, with intrusions and outbursts of granite, probably of very different ages. From observations made in the course of our journey, it appears that there are two distinct directions of strata in the rock which compose this axis, marking it into two districts, one from Lake Superior to Rainy Lake, the other from Lake of the Woods to Lake Winnipeg. Not only the general strike of the altered and upheaved rocks in these two districts, but also the direction in which the water courses affect the principal descents, and the manner in which the lakes in each of them are arranged, all indicate a different direction of the elevating and disturbing force, in other words, two different axes.

These seem to converge towards the south, including an angle of about 25°, the eastern one being directed from the north-east to south-west, while the western one lies much more nearly north and south. In each of these there is a great central district, where nothing but rounded bosses of granite are seen occurring as ridges and islands, which rise little above the level of the flooded country in which they occur. On either side of these two granite districts metamorphic rocks are ranged, with great seeming irregularity as regards their order and dip, but still on the whole preserving their direction very consistently with the bearing of either of the two axes to which they belong. There are besides many minor outbursts of granite as dykes and intrusions, but they do not seem to interfere with above-mentioned general bearings of the country. In a sketch map (sheets 1 and 2)* which accompanies this report, copied from Sir John Franklin's second voyage, the "strikes" have been laid down, and a section drawn at right angles, expressing the various levels, obtained partly by observation and estimate, and partly from authorities cited in Sir John Richardson's "Boat Voyage."

* See Maps 1
and 2 at the
end of this
Report.

By referring to these it will be observed, that in the district between Lake Superior and Rainy Lake the summit level is reached by an abrupt and rapid ascent in a direction at nearly right angles to the main eastern axis. Then follows a long traverse, almost along the summit of that axis, and then an abrupt but comparatively short descent to Rainy Lake again at right angles to the axis.

The first great step in the ascent from the east is made at the Kakabica Falls, where, from a succession of faults which mark the commencement of the more highly metamorphosed rocks, a sudden elevation is effected, the summit level of which is 179 feet above Lake Superior at Fort William.

Sheet 3† is a sketch map of this part of the River Kaministiquia, showing what is probably the structure of the fall.

† See Map 3
at the end.

About one mile below the fall a fine section is exposed in the form of a cliff 130 feet high, crossing the country from north-east to south-west, consisting of a dark argillaceous schist in thin fissile beds from one to two inches in thickness, very much jointed, and having many small veins of quartz, and sometimes calcspar, included both in the lines of bedding and in the joints. These beds are quite horizontal, and through their whole thickness the river has cut its way back to the present position of the fall in a manner similar to that in which the river-bed below the Niagara Falls has been formed. At Lazy Portage, and at various points in the River Kaministiquia below the fall, and also at several of the rapids in the lower part of the White Fish River, small sections of the same beds were seen, but all dipping to south-south-east at 30°. But on ascending the latter river to a point south-west from the Kakabica Falls, there a section is exposed of the same strata, horizontal, like these at the fall, but only 45 feet high. Again, on the River Kaministiquia, above the fall at Friar's Portage, the strata have acquired an almost vertical position, and a little further on, at Lower Island Portage, are found to be dipping at an angle of 40° to south-south-east; and to have become changed in character, having mica developed in them, and also greater abundance of quartz veins than before. Immediately afterwards in the course of the ascent true granite occurs, and, after several alternations, the schistose flags reappear at Upper Island Portage, but now dipping at a high angle to the north-west. The positions of these sudden changes in the dip of the strata have been laid down on the map (Sheet 3) as lines of fault.

From the Falls to the Dog Lake the ascent of the river pursues a northerly course, crossing the beds obliquely by a succession of minor falls, giving rise to scenery of unequalled beauty. At the Dog Portage another sudden rise takes place in the water level, for the rocky high grounds, which for a long way below have been skirting the river at some distance, forming as it were the limits of a wide valley, here converge and form a granite barrier across the river, the summit of which is about 719 feet above Lake Superior, and 440 feet above the river at the lower end of the portage, but only 140 feet above the lake level at the upper end, thus making a rise in the water level of 297 feet in the short distance two and a half miles. As the portage road passes right over the top of this hill, and leads to a point in the lake far from the exit of the river, the nature of the falls which produce this sudden change in level could not be examined, but the mass of the hills seem to be granite. Although this is not the highest point of land over which we passed during the route, still it is probable that this hill is as high as any portion of the rocky axis of the country, as those along the lake are even inferior to it in elevation, while the ascent which is made after leaving the upper end of Dog Lake is through a swampy country covered with drift. In fact, after leaving Dog Lake until a considerable descent has been made to the west, no rock is exposed, the whole summit level being covered with a thick deposit of drift, as will be afterwards described.

From the Lake of the Thousand Isles, where the rocky flooring of the country is again uncovered, until Sturgeon Lake is reached, the descent is very slight, and by referring to the map (Sheet 1) it would be seen that the route follows a chain of small lakes, which are in most cases detached from one another, being separated by rocky barriers, over which the canoes and cargoes are carried. In many cases the lakes are at exactly the same level at each end of the portage, and the greatest difference between the two ends of any of these portages is only about thirty-five feet, so that the total descent in this part of the route cannot amount to very much. This chain of lakes may, in fact, be considered as occupying a line parallel with the summit of the watershed, and the country in which they lie is almost wholly composed of granite, occurring in broad rounded eminences, nowhere rising to 100 feet above the level of this half-drowned country. It is probable that this granitic belt is expanded considerably where the Old Portage route crosses it, and that the whole chain of lakes between Lake Rasiganagah and Sturgeon Lake lies within it. It is this belt which will form the great obstacle to the formation of any kind of road across this watershed.

From Sturgeon Lake in Bad River there is a considerable descent to the south, which forms the only exception to the general north-westerly descent of the waters to Rainy Lake.

From the Lake of the Cross to Lake Namucan the descent is rapid, and the river channel crosses the strata of gneiss and bedded greenstones at right angles, following a direction of the dip.

Rainy Lake has its length agreeing with the strike of the strata, which is here more nearly east and west than before.

Between Rainy Lake and the Lake of the Woods the superficial deposits again cover all rocks from view, and when the north end of the latter lake is reached, and they are again exposed, their general strike is now changed to almost north and south, agreeing with the greater axis of the lake, just as Rainy Lake agrees with the strike of the eastern district. The descent from the Lake of the Woods to Lake Winnipeg is by successive groups of falls, between which the river forms lake-like expansions, which lie generally at right angles to its main course.

The first part of the river Winnipeg flows across vertical strata, and then enters a granitic district very similar to that passed through between the Lake of the Thousand Isles and Sturgeon Lake.

In Sheet 2, it will be seen that the strike of the rocks in this region is generally a little to the east of north, and the nature of the strata is very similar to that of the country east of Rainy Lake but less disturbed by dykes. The exact western limit of the axis at Lake Winnipeg was not seen, but the quantity of loose unwork fragments of lower Silurian limestone scattered about on the banks of the river and on the shore of Lake Winnipeg, indicate the immediate neighbourhood of these strata. At the Seven Falls a large ortho-ceratite was found among the shingle on the river margin.

The distribution of the drift on this axis is very interesting. On the east side for a considerable way above the Kakibica Falls the country is covered with an alluvial deposit of red marl earth. Along the Kaministiquia this forms the high terraced banks of the river, for instance, opposite the mouth of the White Fish River, there are three of these terrace levels at the elevations above the river of 20, 60, and 90 feet. There are scarcely any boulders in this deposit, and when any are seen they are in spots from which this alluvial deposit has been removed, and the underlying rock surface exposed.

On the summit level there is a great deposit of drift, consisting of coarse red sand with many boulders large and small. This deposit forms a flat swampy plain level, and well wooded towards the west, but towards its eastern margin, as at Cold Water Lake, worn into deep dry gullies and round pot-holes or conical depressions without any exit. The thickness of this deposit must be about 200 feet. The highest level of it measured was 883 feet above Lake Superior.

The banks of the lower part of Rainy River are composed of a rich alluvial deposit of a light grey colour, containing a large proportion of white sand. It is distinctly stratified in some parts and is only elevated about ten feet above the river level; no boulders occur in it. As a very slight rise in the level of the Lake of the Woods or a depression of Rainy Lake, would suffice to connect these two lakes along the course of this river, it is not improbable that this deposit has been formed in such an extension of the former lake. But the upper part of the same river has the banks high and terraced, and boulders are plentiful, showing that at this level there is also a deposit of true drift.

Below the Seven Portages on the Winnipeg River there again the river flows through a smooth channel, and the banks are composed of a deposit of soft white marl earth, the river being at first only slightly depressed, but soon from its rapid descent the banks become high as the level of the deposit remains the same. At Rat Portage, however, it retires from the river on either side, and below the falls at that place is replaced by another on another level through a cutting in which the river runs to its mouth at Fort Alexander. The banks of the lower part of the river are very distinctly terraced.

The estimated levels of the drift deposit at Rainy River, the Seven Portages, and at Rat Portage, are respectively 450, 350, and 270 feet above Lake Superior, and deducting 195 feet from each, as the probable elevation of Lake Winnipeg above that lake, we have the levels above it at 255, 155, and 75 feet.

Glacial scratching was very distinctly seen at many points on the route. The direction is almost always north and south. Hardly a surface in the two granitic tracts did not present distinct scratchings. They were seldom to be seen, however, on the southern exposure of rock surfaces, if these sloped much, but the more a surface with a northern exposure sloped, the better they seemed to be marked.

A map has been prepared of the country traversed by the expedition between Fort Garry and Fort Carlton, on which the results obtained have been as far as possible laid down. A copy of this map accompanies this report.*

The country around Fort Garry is a level plain of drift, which consists of a light-coloured marly loam rather deficient in sand with beds of white tenacious clay. Only a few boulders are to be seen scattered over the surface of this plain, generally angular fragments of the Fort Garry limestone of large size. At the Settlement the river is sunk from forty to seventy feet below the level of this plain, but nearer its mouth it flows through a level swampy country, elevated only a few feet above its surface. At the Lower Fort, eighteen miles below Fort Garry, which latter is situated at the junction of the Assineboine with Red River there is a section of magnesian limestone exposed in the bed of the stream when the water is low, and which is then quarried for building purposes. As the river was high when we were there, this section was not visible, but from among the fragments lying on the bank several fossils were obtained, such as Favosites, Septena, &c., and some poor specimens of Receptaculites, but Major Seaton, the officer in command of the troops stationed at the Upper Fort, kindly offered to make as complete a collection as he could when the state of the river allows of the beds being examined, and when the search will be facilitated by the labours of the quarrymen. This limestone is of a light buff colour with purple blotches, very hard and with a sharp angular fracture. At Stony Hill, about fifteen miles north-west from the Upper Fort, there is an isolated bluff of limestone, rising from the plain level to the height of eighty feet. The south and western exposures are abrupt and water worn, it having evidently been at one time an island; and indeed, during the great floods which have several times inundated the Settlement, it has been one of the few spots upon which the inhabitants can take refuge, reaching it by means of boats. The beds of limestone are horizontal or nearly so, and are slightly different from those at Fort Garry in their mineral aspect, having a more crystalline fracture and the colour being of a reddish hue. No fossils can be discovered in newly-fractured portions, but on the weathered surfaces a few obscure remains of fossils are to be seen projecting along with silicious and gritty particles from a dull floury surface.

After leaving Red River, along the whole route to Fort Carlton, at only five localities were any of the strata observed which must underlie the drift throughout this vast extent of country. At Long River, lat. $49^{\circ} 8' N.$, long. $98^{\circ} 35' W.$, a tributary of Pembina River flowing northwards, and again at Forked Creek, a deep gully that joins the valley of the Assineboine in lat. $50^{\circ} 6' N.$, long. $101^{\circ} 18' W.$ sections were observed of a compact shale, of a light greenish drab colour, not occurring in continuous layers, but as fragments with irregular concoidal surfaces which have been produced by the desiccation of what was originally thin continuous beds of clay. Sometimes it makes a nearer approach to a slaty character. Among these beds are bands and nodules of a hard deep brown-coloured clay ironstone, and perpendicular fissures are common, which are filled up with splintery iron shale. A careful examination of these beds at Long River did not afford any fossils, and a long search of those at Forked Creek only yielded six or seven very minute specimens, among which were scales of fishes (clenoids?), a small bivalve, and several obscure impressions. Throughout these shales there occurred ochery calcareous tubes, about a half line in diameter, traversing the layers perpendicularly. At both these places the thickness of the strata exposed amounts to about 30 feet. At Long River they dip to the south, but not with regularity. At Forked Creek the strata are strictly horizontal, and were seen in two creeks two miles apart, having exactly the same characters. No clue could be discovered to their relations with other rocks, as the sections only occurred in deep bends in the creeks, for all else was obscured by drift. At Long River they were covered by about six feet of pure white sand, very incoherent, and over this lay the ordinary drift, consisting of light grey calcareous earth. At Forked Creek they were overlaid by about 20 feet of drift.

At Fort Ellice the banks of the Assineboine are 200 feet high; and at one point there, a recent slide had taken place, a partial section of the bank was displayed. The upper part of this section consisted principally of comminuted fragments of the same *Long River shale*, with local beds of pure sand, also the more common grey drift.

At a part of this slide which was cut by a bend of the river, strata of tenacious calcareous clay were visible, of a dark purple black colour, but with the weathered surface decomposing into a red ferruginous earth. Along with these clay strata were two beds of soft clay ironstone, about four feet apart, the lower one a half-foot thick, and rather compact, the upper one concretionary, forming thick nodulated masses, the upper surfaces of which were calcareous, and very like decomposed coral.

At the elbow of the south branch of the river Saskatchewan, at the point where it meets the great Prairie ridge, known farther south as the "Coteau des Prairies," similar clay beds were seen, having the ironstone concretions occurring in great profusion, and in several of these were found fragments of chalk fossils, inoceramus, baculites, and others. As the mineral resemblance to those beds at Fort Ellice is perfect, there can be no doubt as to their similarity in age. At the elbow the section is one of great interest, from the relation of these beds to the drift by which they are covered. Sheet 4 is a sketch map of the river a little above the elbow, with a section exhibiting the manner in which the beds occur. In the section, the pale blue colour represents the soft clay strata, which are almost horizontal, while the ochre tint represents the drift. This latter thins out as it nears the "Coteau," which is probably mainly composed of the clay strata, with only a thin covering of drift on its eastern aspect. As this part of the river was the western limit of our journey this year this point could not be determined. Seeing that the under surface of the drift lies unconformably with these soft clay strata, it is evident that the eroding agency has had its western limit here, the cause of which was certainly not the hardness of the beds that it encountered. Portions of these soft strata have been formed by the action of the river into conical mounds, which present a most extraordinary appearance. As no grass has time to grow on them, from the constant attrition of their surface, they are perfectly black, and their outline is broken into terraces by the successive lines of ironstone concretions, which, from their hardness, retain the soft strata underneath them. There is a large quantity of gypsum disseminated

* See Map at end.

throughout these beds, occurring as transparent selanite crystals in radiating groups. There are no large beds or masses of it.

From Fort Ellice a trip was made for a few days' journey to the south-west, in consequence of the reports by the Indians of wonderful stones that occur on the banks of the Assouri River. The place is called by the half-breed hunters La Roche Percée. The route followed to this place passed by the eastern end of Moose Mount, which will be described afterwards in connection with the drift, and of which it seems to be entirely composed. The ascent to the base of this hill was about 400 feet above the Assineboine at Fort Ellice, and in continuing southwards until we struck the Assouri, a descent of about 100 feet was made. Thus the probable height of the plain through a cutting in which the Assouri runs in this place is 300 feet above the Assineboine, while the valley of the river is 165 feet deep, so that the difference of level between the two rivers amounts to about 135 feet.

The direction of the Assouri here is easterly, and Sheet 5 is a rough map of a portion of it, with a view of its north bank. The whole prairie here is covered with a most extraordinary profusion of boulders, which are fragments of granite, gneiss, limestone, &c. In the valley, a group of strata is exposed, a section of which is given in Sheet 6, as follows:—

	Feet.
a Drift with boulders from	4 to 7
b Mud stone	1
c Incoherent sandstone, fine grained, with hard concretions impregnated with iron, which weather concentrically	10
d Porous calcareous scinter	1
e Hard dark blue ironstone shale, decomposing into deep orange coloured splinters	2½
f Gritty limestone	2
g Ash coloured clay in thin indistinct layers, very soft, with one bed of coal nine inches in thickness	8
h Hard blue limestone	3
i Same as g, but with three beds of coal, ten, eight, and six inches in thickness	15
k Gritty limestone	2
l Brightly coloured marls and shales, with selanite in small fragments	10
m Very coarse grained incoherent sandstone more than	20

No trace of fossil remains were found in any of these beds to indicate their age.

The coal does not occur as well-defined beds, but graduates into the shales on both surfaces. It is not visible until a light ashy deposit is removed from the exposed edge of the bed, produced by the soft clay washing down from the strata above. The coal is of several qualities, some having quite the appearance of compact Cannell coal of fine quality, some like the more glistening bituminous coal friable, and only to be obtained in small cuboidal fragments, while some can hardly be distinguished from charcoal. Where we crossed the Assouri, between Turtle Mount and Fort Ellice, fragments of similar coal were picked up in the bed of the stream, no doubt derived from these seams. Also at the elbow of the south branch of the Saskatchewan like fragments were found, so that we may expect to meet with similar beds in the course of our journey up that river during the next year. A rough analysis of an averaged specimen of this coal on a small scale give the following results:—

Aqueous and volatile matter	40 per cent.
Carbon	50 "
Light orange colour ash	10 "

In the first of these groups there seem to be an unusual deficiency of tar and coal gas. It burns in the air with difficulty, without flame.

The sandstone which forms bed C. is composed of very fine pure grains of quartz, hardly cohering, but in the upper parts of the bed, there occur concretions impregnated with iron and of a reddish hue, which are comparatively hard, and decompose concentrically. It is this irregular disintegration of this bed that gives rise to the curious appearances that have rendered this spot an object of great superstition among the Indians. The lower sandstone wears away from under the hard concretions, which, from their peculiar manner of weathering, assume the forms of compressed spheres, and sometimes long cylinders like the boilers of a steam engine, and these are left elevated on pillars of the white sandstone. The gullies which join the main valley are thus peopled with grotesque forms, some exactly resembling the ruined nave of an ancient abbey, while those concretions which have just reached the surface, but have not yet become isolated by the disintegration of the bed below, may be taken for gigantic tombstones, and so further the illusion. The sandstone at the base of the section is also very incoherent, but composed of larger grains. The strata are not found in the same proportion and order in different parts of the valley, but they are always horizontal. The thickest bed of coal that was seen was one foot, but the ashy clays were at some places very much thicker than at others. The marly shales (lettered L.) have quantities of gypsum embedded with them, but only in small detached crystals. In regard to their probable age the description of the upper beds of the cretaceous system given by M. Jules Marcou in the 75th page of his "Revue Explicative d'une Carte Géologique de l'Amérique du Nord," seems to be that of very similar beds to those seen here. The position of "Roche Percée" is lat. 49° 6' N., long. 103° 59' W.

The whole country traversed by the Expedition during the last year has been overspread by superficial deposits of great thickness. Although these might be all included under the group of Northern Drifts in the ordinary acceptation, still it is probable that they consist of deposits of very different ages, and circumstances of deposition. Three boldly marked levels were observed of different mineral composition as well as geographical distribution. To the first of these belong the deposits of the wide flat plain upon which the Red River Settlement is situated; this forms the first prairie level. Its composition is marked by a preponderance of argillaceous marl and a deficiency of sandy matter, and it is invariably stratified in thin layers. Underlying this, at various depths from the surface, is a bed of stiff light-coloured clay, and which forms the immediate margin of the river in many points. The upper parts of the deposit contain leaves and fragments of wood and reeds, and the whole has quite the

appearance of a fresh-water deposit, indicating a time when Lake Winnipeg covered a much more extensive area than it at present occupies.

The surface of this deposit must be from 75 to 100 feet above the lake, but it slopes from the west towards Red River, and at St. Joseph's, where the second prairie level supervenes, it may be 100 feet higher. The first prairie level has a very irregular outline to the west. Pembina Mount at St. Joseph's is formed by the eastern limit of the second prairie level at that place. It follows a northerly course as an abrupt terrace, varying from 200 to 300 feet above the first level for about 30 miles, when it turns to the north-west, and assumes at the same time a more gentle slope, up which our route lay. Sheet 8* is a rough reduction of the larger map, having the different levels exaggerated, so as to render them more distinct. Colours have been used to represent the probable range of these different levels.

* See Map 8 at end.

The composition of the second great level is very different from that of the first. Sand is the preponderating ingredient. Thus at St. Joseph's, where the banks of the river Pembina present a fine section of it, the material is coarse red sand with gravel and boulders, very similar to that observed on the eastern limit of the drift beds on the summit of the water-shed between Lakes Superior and Winnipeg. There are no signs of stratification in any part of this deposit, as seen at Pembina Mount. Further west, however, it assumes a light grey colour, and contains a considerable portion of lime. At Fort Ellice, as before mentioned, the upper portions of it consist entirely of fragments of the Long River shale. That the whole thickness of this level at every point is not formed of drift, is proved by the discovery of the shale beds at Long River and Forked Creek, forming as it were a nucleus to it. Notwithstanding that this level is everywhere cut to a great depth by rivers and creeks, very little can be learned of its nature at different points, as slides at the banks of the gullies are but rarely seen. The slide near Fort Ellice, of the banks of the Assiniboine has been spoken of in connection with the beds, probably of cretaceous age, which are visible at the base of it. Another similar slide was seen at the Qu'Appelle Lakes, which are a succession of dilatations of the rivers of that name lying in the bottom of a deep wide valley cut through this second level. This slide did not expose the bank quite to the base, but as far as was visible consisted of a stiff sandy clay, of a light red colour, with patches of blue clay and gravelly beds. In fact, the characters of this level, as far as regards its mineral composition, seem to be very variable and local. Boulders are tolerably plentiful all over it, but occur in greatest quantity upon the sides and summits of ridges and mounds, which are irregularly dispersed over this level, rising abruptly and generally to the height of about 50 feet. A great deal of this level is clothed with clumps of poplars. There are, however, some large tracts of bare plain.

The third level is what is spoken of by the hunters as La Grande Prairie. The route of the expedition did not traverse this level at all, its westerly course meeting it only at the elbow of the south branch of the Saskatchewan, at which place the approach of winter compelled us to turn northward. There are, however, two hills, or mountains, as they are termed by the hunters, viz., Turtle Mount and Moose Mount, which seem to be detached outliers of this level, their summits having nearly the same elevation as that of the summit of this level. These hills are very much alike, consisting of irregularly disposed ridges and cones of very coarse drift, highly charged with boulders. Some of these cones have very steep sides, and rise to the height of 300 feet from their base, and their summits are about 600 feet above the second prairie level. The northern aspect of these hills is very irregular, as also their central mass, being mostly densely wooded, and enclosing numerous small lakes, but their southern aspect is a long gentle slope utterly devoid of trees, and being continuous with the level prairies beyond, which reach as far as the true eastern limit of this level the "Coteau de Prairies."

The Great Prairie ridge of the hunters has a direction from north-west to south-east, with its northerly aspect very much furrowed in the same manner as has been mentioned in reference to its two outliers, Moose Mount and Turtle Mount. At Roche Percée this ridge was about ten miles to the south, and the extraordinary profusion of boulders at that place, and the thin layer of drift, which covered the coal bearing strata, together with the facts which were observed with a similar proximity to the "Coteau" at the elbow of the Saskatchewan, all indicate that the drift has at the "Coteau" its south and westerly boundary.

(Signed) JAMES HECTOR, M.D.

Fort Carlton, December 14, 1857.

Enclosure 4. in No. 6.

SIR,

Fort Carlton, Saskatchewan, June 7, 1858.

DURING the latter half of last October I proceeded to Fort Pitt and obtained the horses which you had ordered at that place for the service of the expedition. On my return I made observations for latitude and longitude at various places on the route, and constructed a rough map of the country between Fort Pitt and Carlton.†

Encl. 4. in
No. 6.

I found, on my arrival at this place, that Lieut. Blakiston was busily engaged making preparation for carrying on a system of magnetical and meteorological observations during the winter months. We commenced the observations on November 12, each member of the Expedition taking six hours watch during the day and four during the night, in rotation. I continued on duty at the Fort until February 25, when a scarcity of provisions being felt, I proceeded to Pike Lake, where fish at least could be got. While I remained at the lake, which was from March 1 until April 2, I was employed chiefly in obtaining fish, and in that short time caught upwards of 100 jack fish, besides a few white fish.

There has been a great scarcity of provisions throughout the Saskatchewan district; the Indians have been reduced to eating their horses, and hunting wolves and foxes for food, as not a single buffalo has appeared for many miles on either side of the river, except at Edmonton where they have been so thick as to defy the hunters running them.

† This map has been reduced and incorporated into the long map, which will be found at the end of these reports.

On April 1, Dr. Hector, who according to your orders had been to Edmonton on business connected with the Expedition, arrived at Pike Lake on his way to Carlton; so I accompanied him to this place, where we arrived on April 7.

Throughout the winter, as previously, I have kept up regularly the journal of the Expedition, and although it is meagre in detail during the depth of winter, yet as the spring advanced I have been very careful to note everything characteristic of its advancement. In addition I have taken the temperature of the river daily from the breaking up of the ice till now, and noted either its increase or decrease of volume very carefully. I learn from Dr. Hector that he has a number of like observations which he took in the autumn before the ice formed on the river, so an interesting comparison may be instituted between the two sets of observations.

During our stay at Carlton I have made a complete series of observations for latitude and longitude, and frequently in the winter I have taken observations to ascertain how my chronometers behaved. Thirteen lunar distances are worked for the longitude of this place, and I have as many more yet to work.

In the many spare hours which I have had in common with the other gentlemen of the Expedition, I have collected a large number of insects and other animals and various shells, for the purpose of getting them forwarded to England. There is one squirrel in the collection which is undoubtedly new; it resembles the *Arctomys Hoodii*, but is much smaller, and is not patched with light hairs on the dark stripe as is that animal.

Captain Palliser, Commander of
North British American Exploring Expedition.

I have, &c.
(Signed) J. W. SULLIVAN,
Secretary to Expedition.

Encl. 5. in
No. 6.

Enclosure 5. in No. 6.

OBSERVATIONS of the TEMPERATURE of SOIL at various Depths, and the Depth of the Frozen Ground.

Fort Edmonton, 1858.

1. On the 22d February commenced digging a hole in the field behind the fort, on the top of the high bank on which the mill stands. In three days reached the depth of 4 feet 6 inches; ground still hard frozen. The digging was discontinued in consequence of the man being required for something else.

2. March 3d. The digging recommenced to-day, but as the ground must have frozen in the bottom of the old hole, a fresh one has been commenced 6 x 4 ft. in the same field, but on a level with the fort at a distance of 12 yards from the pickets. The soil is the same as that displayed in the last hole; dark loam for 9 inches, then a yellow reddish earth, enclosing fragments of the beds associated with the coal, also angular pieces of the coal itself, rounded fragments of gneiss, quartz, &c.

March 4th. The hole is now dug to the depth of 4 feet 10 inches, the last 3 feet through fine light red sand, which was so dry as almost to look like unfrozen earth, however it got so much softer, and broke down so fine after it was extracted, that there is no doubt that it is still frozen. But besides, a bed has been reached of a white earthy clay, including fragments of coal, so hard frozen as to resist the pick and the borer, and which on being thawed softens completely.

This afternoon I bored a hole with the auger in the bottom of the dug hole and intended to carry it down three feet, but the clay bed proved too hard for the auger to pierce, so after I got down three inches, I placed the thermometer in it, packed it round with soil, and then filled the large hole with a foot or two of hay to prevent the temperature of the atmosphere during the night from influencing it.

March 5th. Thermometer, at 5 feet, at 8 a.m., 30°; surface, 20°.

The unfrozen soil was at length reached to-day, at the depth of 7 feet 6 inches, in a bed of sand with rounded stones, and the line of frozen soil was easily perceived. The hole is dug for 4 inches below it, and then four inches more were bored, and the thermometer placed in it at the depth from the surface of 8 feet 2 inches.

March 6th. Thermometer, at 8 a.m., 33° (at 8 ft. 2 in. from surface); surface, 38°.
" " " at noon 33° " " " 49°.

3. March 2d. In the field behind the fort, at a short distance from the pickets (20 feet) bored a hole one inch in diameter to depth of two feet, placed thermometer at bottom, having its bulb covered with tow, and being enveloped in a metallic case; then rammed in a plug of tow above it so as to prevent the air having any access to it. The following are the readings of thermometer:—

March 3d, at 8 a.m., 18°·5; surface, 20°.

" " at noon, 18°·5 " 24°.

" " 4 p.m. 18°·5 " 24°.

4. March 3d. Increased the depth of hole to 3 feet, and adjusted the thermometer as in 3. Readings as follows:—

March 4, at 8 a.m. 21°·5; surface 23°.

" " at noon, 21°·5; " 30°.

" " 4 p.m. water had filled it, from the melting of the snow, and hot water had to be poured down to get thermometer out.

5. February 25th. After three days' thaw the surface of the field behind the Fort is converted into a soft mud to the depth of three inches, and the ground is thawed to the depth of eight inches. This is on a slope where no water has lodged.

February 27th. The ground this morning is as hard frozen as ever again. The frost of twenty-four hours, having a minimum temperature of 0·5 having proved sufficient to re-solidify it to the full depth to which it had been softened.

JAMES HECTOR, M.D.

Enclosure 6 in No. 6.

Fort Carlton, Hon. Hudson's Bay Company,
Saskatchewan, June 8, 1858.

SIR,

In accordance with your instructions, that I should make every effort to engage twelve or fifteen men, and obtain at least 15 horses for the use of the Expedition during the next season, conveyed in your letter written from *Touchwood Hill Post*, and dated 16th October last, during the early part of the winter I made every inquiry as to the facilities for carrying out your wishes. The result of this inquiry convinced me that it was necessary that I should make a winter journey, at least as far as Fort Edmonton, as it is only there that any half-breed population is to be found not under direct engagement to the Hudson's Bay Company.

Accordingly, having obtained dogs, and completed all other arrangements, I left Fort Carlton on the 14th of December.

Up to this time I had taken my share in the hourly observations which Lieutenant Blakiston was engaged in carrying on, and which commenced on the 12th of November, and previously to that time I made a six days' trip to the north-west for sixty miles, to examine the Thickwood Hills, which bound the Carlton Plains in that direction by an abrupt densely wooded terrace, about 500 feet in height.

From Fort Carlton to Fort Pitt, the next highest Company's post on the river, I found the distance to be 199 miles, but the track I followed is about twenty-miles longer than the usual one, but was preferred, as it is so much easier for the dogs to follow a track already beaten, than open a new one through the snow. We skirted a range of hills which forms a continuation of the Thickwood Hills to the west, and passed over many lakes, the principal of which are Redberry Lake, seven miles wide and ten miles long, and Jack Fish Lake, eight miles wide and twelve miles long. At the latter of these I found a small temporary post of the Company's, which was only in the course of erection. I heard here that the buffalo had been very numerous, but that they had all been passing to the south-west, and now none were to be seen but a few straggling bulls.

We reached Fort Pitt on our seventh day from Fort Carlton. It stands on the left bank of the Saskatchewan, at a point where it takes a bend to the north. Before reaching the latter place, however, it makes a great sweep to the south, passing along the base of the Eagle Hills, which I had observed as a blue line skirting the southern horizon.

Fort Pitt is in latitude $53^{\circ} 30' N.$, and longitude (Leftly) $109^{\circ} 10' W.$

On the 24th of December, accompanied by Mr. Simpson, the gentleman in charge at Fort Pitt, I started for Edmonton House. With the exception of the first day's journey, our road lay along the south side of the river, so as to cut off a great bend which it makes to the north between the two places. The country now passed through was on a much higher level than that before reaching Fort Pitt, agreeing with the summit of the hilly ground which was then skirted, and from this level other hills again rose. The rise of the country to Edmonton is very inconsiderable; nevertheless, when the distance is considered, hardly amounting to 1,000 feet.

For the first few days after leaving Fort Pitt, we found the plains covered with buffalo; and early one morning I was fortunately at a camp of Indians just as they had filled their pond with about 100 of them, and were carrying on an indiscriminate slaughter. The pond is an enclosure of stakes and branches of trees interwoven, having one broad entrance; but which is so constructed that the buffalo, once driven in, cannot again escape. At almost every camp of Indians, of which nine were passed since leaving Carlton, I saw one or more of these ponds, and I believe the number of buffalo killed in this manner in each year throughout the Saskatchewan district is enormous. After the pond is filled they must of course slaughter every animal before they can remove any of the meat.

The country to the south of the river through which we passed is more generally wooded than it is reported to have been some twenty or thirty years ago, but the wood is all of a worthless character, consisting of small poplars, with only a few clumps of spruce in the swamps as Edmonton is approached.

On the 30th of December, our sixth day from Fort Pitt, we arrived at Edmonton House. The distance I found to be 191 miles. The snow had been rather deeper than formerly, so as to render the rate of travelling slower.

Edmonton House, which is a large establishment, and the residence of the chief factor, who controls the district, is built on a high point on the left bank of the river. There is a windmill behind the fort, and a good deal of land enclosed for cultivation. The river is here 200 yards wide, and enclosed by banks 160 feet high, in which are exposed sections of the beds which contain coal. This coal occurs in three or four beds; the principal of which is from four to six feet thick. It is of very inferior quality, burns with no flame, but rather smoulders away, leaving a plentiful ash. The beds associated with it are of grey sandy clay, containing ironstone, nodules, and also argilo-calcareous shales. It is used in the forge at the fort, and is found to answer tolerably well.

The half-breed settlement, where I expected to find men, I found to be situated about fifty miles to the west of Edmonton, but as I learnt that all the population was absent on the plain hunting, I did not visit it at this time.

On the 9th of January I started for Rocky Mountain House, for the first three days travelling due south nearly, and afterwards turning to the west for three days more, arriving at that place on the 14th. The distance I found to be 157 miles, but there was little or no snow on the ground, so that it was very hard work for the dogs. The road lay over a succession of wooded ridges, the western slopes of which were covered with young poplars, while the eastern slopes and the swampy valleys between support a growth of spruce.

From a rising ground, known as Gabriel's Hill, I obtained the first view of the mountains the evening before I arrived at the fort.

I found the Mountain House to be an establishment about the size of Fort Pitt, but in a very ruinous condition, owing to its being abandoned every summer, when it is generally adopted as a residence by several families of Indians, who prove anything but improving tenants.

It stands on the left bank of the river which is 150 yards wide, and about half a mile above the mouth of Clear Water River, a large branch which joins the Saskatchewan from the S.E.

I remained here until the 26th, making excursions in every direction for the purpose of examining

Mr. Sullivan, during a visit to Fort Pitt, in Oct. last, found the long. by chron. obs. to be $109^{\circ} 8' W.$

the beds exposed in the banks of the main river and its tributary, which are very interesting. They belong to the same series as those at Edmonton, and coal is found abundantly, although no bed that was observed is more than two feet thick. The principal feature of the river here, however, is the occurrence of thick beds of incoherent sandstone of coarse texture which forms cliffs sometimes 100 feet high, overhanging the river, giving it a very different character from the tame sloping banks lower down in its course.

The Mountain House is at the distance of not less than 100 miles from the main chain of the Rocky Mountains, which are nevertheless distinctly seen from it as a chain of snow clad peaks. The principal chain is, however, screened by a nearer range, distant about 45 miles. The view of the mountains occupies the arc of the horizon, from south by east to west by north. The near or Brazeau's range, merges with the main range towards the north, but lying more east and west than the line of lofty peaks at its southern extremity, it is far distant from them.

I made an attempt to reach this near range, but failed in forcing a road through the dense pine woods with which the whole country is covered.

For a short time after my arrival the place was reduced to great straits for provisions, but a camp of Blackfoot Indians arrived, bringing with them a small quantity of dried provisions so as to give temporary relief.

I met six of the principal chiefs of the Blackfoot Natives, and explained to them the objects of the Expedition, and the course it would likely pursue when passing through their country, and obtained a promise from them that they would take steps to prevent the young braves of the nation from stealing our horses or otherwise molesting the party. I gave each a small present and a paper in which their promise was embodied. The lat. of the Mountain House is $52^{\circ}29'N$, the long. by account $115^{\circ}2'W$. By a comparison of observations made with the barometer during my stay, and those at similar times at Fort Carlton, I found its altitude above that place to be 2,029 feet.

The mean temperature for the time I was there is 10° higher than for the same time at Fort Edmonton, but for many days a soft south-west wind blew, which does not seem to have affected the temperature at Edmonton in the same degree, which accounts for this great difference.

Having obtained all the information concerning the country which might be of use to you in making your plans for next year, and learnt the names of the best guides, &c., I started on my return to Edmonton House on the 26th of January. In order to obtain a clearer understanding of the structure of the country, I descended on the ice of the river all the way, and found the distance to be 211 miles. As we were only sparingly supplied with provisions we had to go very fast, and reached Edmonton after having slept only three times. The last day of the journey, as we had nothing left to eat, we did not think it worth while stopping, so we travelled 21 out of the 24 hours, and in that time went 90 miles.

The coal bearing strata are exhibited more or less continuously throughout the whole of this portion of the river, but about 130 miles above Edmonton the last of the sandstone bluffs is seen, and the strata assume the argillaceous character which they present at that place. Sections and a minute description of these strata, along with my journal, will be, however, submitted to you.

The month of February was occupied at Fort Edmonton in making an examination of the surrounding country and other observations. I made an excursion to Lake St. Ann's, to visit the Settlement and Roman Catholic Mission there, under the superintendence of M. Le Combe. It is 50 miles W. by N. from Edmonton, and consists of 45 houses in three little villages on the west shore of the lake, which is about 14 miles long and 7 wide. There is a nice little chapel, but at the time of my visit all the inhabitants, with the exception of three or four families, were absent on the plain.

On the 7th of March I set off to the plains to meet the Freemen, having heard that they were now all together and on their return. I met them in the neighbourhood of Battle River, and succeeded in engaging the guides and men I wanted. These freemen seem to be a thriving class, and have none of that love of personal display and extravagance which is such a blot on the character of the Red River half-breeds.

On the 15th of March I left Edmonton, and continued to descend the Saskatchewan on the ice. Four miles below Fort Edmonton I saw the coal for the last time, and at the distance of 80 miles the associated beds disappear, and the clay strata with the ironstone nodules which were first seen at the elbow of the south branch last year, and which are of cretaceous age, take their place in the bank of the river, to all appearance having the coal bearing strata conformably superimposed.

As we approached Fort Pitt we found the snow on the river, and also all over the country, to be very deep, so that for the first time throughout the whole trip we had to take to snow shoes in earnest, which says a great deal for the unusual mildness of the winter, or rather the absence of snow, for the cold at some periods was very severe. I found the distance by the river to be 251 miles. The heat of the sun, from melting the surface of the snow, caused us to travel during the night, and rest in the day, during this part of the journey. I arrived at Fort Pitt on the 21st of March, but finding that letters had missed me on the road, I had to wait there until the 30th. The ice on the river was now getting so bad that it could no longer be safely travelled on, so that I had to return by the usual track to Fort Carlton. On the 1st of April I reached Jack Fish Lake, where I found Mr. Sullivan, he having been obliged to leave Carlton on account of the scarcity of provisions.

At this place I had to give up the use of sleighs, as the ground was now quite bare. I had *travaillés* made for my dogs after the method of the Indians, and along with Mr. Sullivan in this manner we reached Carlton on the 8th of April.

Here I found the men you had engaged at Red River, and who had only arrived the day previously. As the people at the Fort were next thing to starving, I at once despatched them to the nearest point where buffalo were to be found, so that they might hunt for themselves.

Until the 7th of May I was occupied at Carlton, when I again started for Fort Pitt to meet the men I had engaged, and whom I had directed to come to that place with the Company's annual brigade of boats. I had already sent up a supply of clothing, &c. for them.

I got to Fort Pitt on the 10th, but the unusual lowness of the river delayed the brigade, so that it did not reach that place until the 15th and 18th. I then got the horses ordered from the Company,

and which were in readiness at Fort Pitt, and sent the men at once to a rendezvous to the south of the Eagle Hills, where in all probability they will meet in with the party of Red River men. I did this, as it was impossible for them to be fed at Fort Pitt, as the buffalo were distant many days. Two of the party are to come on to Carlton, to guide us back, so as to avoid any chance of missing them.

On the 22nd of May I left Fort Pitt to descend the river along with the brigade, and so complete the survey of it (which I had made during the winter, from about one day above the Mountain House) as far as Carlton. The distance, by the river, between the two places is about 235 miles, and it occupied us seven days. These boats draw only one and a half to two feet water, and are led by guides long used to navigate the river, yet from the shallowness of the water, and the great intricacy of the channel, the boats were constantly running aground, keeping the men constantly wet from morning to night, from having to jump into the water every time to shove them off.

The river above Carlton is certainly unnavigable except for the smallest craft, and even then only with great difficulty.

While at Fort Pitt, waiting for the brigade, I had an opportunity of examining the cretaceous beds, and obtaining a few more of the characteristic fossils. At about ninety miles above Carlton, or about forty-five miles above the elbow of the north branch, they were observed for the last time in a section of the flank of the Eagle Hills.

From Mr. Swanston, the gentleman in charge at Fort Edmonton, I received a valuable meteorological register which he had kept, with a thermometer furnished by myself, continuously from the 1st of January till the 15th of May.

By a comparison of barometer readings at Edmonton during the months of January and February, with the similar readings at Carlton, the approximate difference of altitude between the two places is found to be 922 feet.

This meteorological register, with all other meteorological and other observations, along with the journal of this trip, will be submitted to you as soon as completed.

I have, &c.,

JAMES HECTOR, M.D.

To Captain Palliser, commanding North British
America Exploring Expedition.

No. 7.

No. 7.

COPY of REPORT from Captain PALLISER to HER MAJESTY'S SECRETARY OF
STATE FOR THE COLONIES.

Fort Carlton, Saskatchewan, June 5, 1858.

(Received September 6, 1858.)

SIR,

I HAVE the honour to report my arrival at this post on the 4th of June.

Owing to the absence of buffalo during the winter my hunters, as well as those belonging to the Fort, have had to go to great distances in order to get meat, which they obtained in such small quantities that the Hudson Bay Company's officer in charge of this post was obliged to scatter the men with their families all over the plains in search of food. Even Dr. Hector and Mr. Sullivan were obliged to leave this post and go to Forts Pitt and Edmonton in order to lessen the consumption of meat, for which the supply here was quite inadequate; fortunately, however, the winter has been an unusually mild one, otherwise the consequences might have been very serious indeed.

I am happy to say that I have been most fortunate with regard to the horses; very few have died, and almost all the rest are in good working condition, and in far better order than when I started last year from Red River.

I am now about to start with the main branch of the Expedition to the Forks of Red Deer and Medicine Rivers, and despatch Lieut. Blakiston with a branch expedition, via Forts Pitt and Edmonton, in order to carry on the magnetic determinations at those posts, as well as to bring us supplies overland in carts, ordered up in boats from Norway House last winter, to meet us at the Forks above mentioned. Lieut. Blakiston, with the supplies, will join the main branch of the Expedition, and we shall proceed to an old Fort at the foot of the Rocky Mountains not far from the boundary line, thence I shall trace the boundary line to the westward, and afterwards take a course to the northward in search of a pass practicable for horses over the Rocky Mountains within the British territory.

I purpose then to send the Expedition into winter quarters at Edmonton, and proceed with one or two men across the Rocky Mountains to meet Captain Hawkins.

I am in receipt of your last communication of the 29th of March, conveying the suggestion of the Geographical Society, viz., "to deposit for Captain Hawkins' use at Fort Assineboine the records of my observations to the north of the 49th parallel." Fort Assineboine was situated on a tributary of the Mackenzie River which flows into the Arctic Ocean; the post has for several years ceased to exist, and I hope to avail myself of an easier way to communicate with Captain Hawkins, as I learn that Mr. Dallas of the Hudson Bay Company is crossing the mountains by way of the boat encampment

and Athabasca portage, and the men who return with the boats down the Columbia can take back despatches from me. I intend to adopt this means of communication in case I might subsequently fail in finding a practicable pass for horses across the Rocky Mountains within the British territory, and so fail in having a personal interview with Captain Hawkins.

I enclose letters from Lieut. Blakiston and Dr. Hector, and Mr. Sullivan, concerning their operations during the winter of 1857-58. Also M. Bourgeau's botanical report, which I shall feel obliged by your submitting to Sir William Hooker.

I have likewise the honour of enclosing the map of our explorations in 1857, containing also my route from Red River this spring.*

* * * * *

As soon as my men are all collected from the plains where they have been in search of food, and making provisions, I shall start the Expedition. This will probably be effected about the 12th of this month.

I would strongly recommend Her Majesty's Government at the termination of my Explorations to attach Lieut. Blakiston to Capt. Hawkins' staff, in order to continue across the Rocky Mountains his very valuable series of magnetic and meteorological observations.

Her Majesty's Principal Secretary of State
for the Colonies.

I have, &c.,
(Signed) JOHN PALLISER,
Captain Commanding
N.W. America Exploring Expedition.

* This map has been reduced and incorporated into the long map, which will be found at the end of these reports.

No. 8.

COPY of REPORT from Captain PALLISER to the Right Hon. Lord STANLEY, M.P.

Fort Edmonton, Saskatchewan,

October 7, 1858.

My LORD,

(Received January 25, 1859.)

I HAVE the honour to report the safe return of myself and my secretary, Mr. Sullivan, to winter quarters; also the return of Lieut. Blakiston with the branch expedition I had sent to explore the Kootanie Pass. I have also to report the return of Mons. Bourgeau, whom I also sent on a botanical tour into the Rocky Mountains, with directions to follow any route where he thought he could best further the interests of botany.

Arrival at
Edmonton.

I am rejoiced to say that I have completely succeeded in discovering not only a pass practicable for horses, but one which, with but little expense, could be rendered available for carts also. This pass will connect the prairies of the Saskatchewan with Her Majesty's Possessions on the west side of the Rocky Mountains. The pass is situated precisely where I had long supposed, and this impression was communicated by me to Her Majesty's Government previous to my appointment to the command of the Expedition.

Have dis-
covered a
Pass within
British Pos-
sessions.

I shall now endeavour to give a summary of the movements of the Expedition, since the commencement of June 1858 up to the present period; also of the branch expedition of the gentlemen whom I dispatched at different times for that service.

Early in the month of June, I despatched Lieut. Blakiston, by Fort Pitt and Fort Edmonton, on the north branch of the Saskatchewan River, in order to carry on the magnetic determinations at those posts, as well as to bring us supplies overland, which supplies were every day expected up in the boats. I then started with Dr. Hector, M. Bourgeau, and Mr. Sullivan, for the Eagle Hills, with the intention of exploring the region of country between the north and south branches of the Saskatchewan or Bow River. I was then accompanied only with the men I had engaged at Red River Settlement, and with them went as far as the Cross Woods, where I left them along with the gentlemen, with orders to await my return. I then started with two men and one pack-horse, rode about 80 miles in quest of my St. Ann's Brigade, whom I had sent on the prairie to the south of the Eagle Hills in search of buffalo, the game being so scarce that I could not run the risk of keeping so large a party together. After two days' ride I found their camp; they had not only lived well, but had been able to comply with my directions, to dry meat for us, for we had started almost without provisions. I lost not an hour in leading them to join my Red River Brigade, and on the fifth day reached the Expedition at the Lizard Lake. Here we passed our first Sunday.

Movements
of the Ex-
pedition.Red River
Brigade.St. Ann's
Brigade.

All my Red River men belonged to the Church of England, consequently I read prayers for them; but also, the St. Ann's men, half breeds, who, although of the Catholic persuasion, asked and obtained leave from me to attend Divine worship, and I conducted the lessons and half the prayers in Cree through the medium of an interpreter. I mention this circumstance to show the respectful tendency and absence of bigotry of these men, in their appreciation of Divine service.

Service on
Sundays

Our supply of provisions was very small; we had meat only for three days, and about three stones of flour, for a party consisting of my three companions, myself, and 28 men. I had, however, tea and sugar remaining from last year's store, which, together with what I brought from Red River Settlement, has lasted us pretty well through the season.

Scanty sup-
ply of pro-
visions.

The absence of all flour and vegetables did not inconvenience either us or the men in the least, and I found the tea very useful in counteracting the injurious effects of the swamp water, which otherwise might have produced many cases of dysentery.

The country surrounding the Eagle Hills and Lizard Lake is rich, and wood abundant, but the timber is not of a valuable description, being chiefly poplar and willow. Here I learned that the war had broken out between the Cree and Blackfoot nations, and that a large number of Indians were on their way to pay me a visit. Knowing that they would have little or no provisions to trade, and fearing their importunity, I made a few forced marches and got into the Blackfoot country.

Eagle Hills.

Arrival in
Blackfoot
country.

On the 22nd June we reached 108th degree of west longitude, in lat. 52° N. The ground offering very bad pasture, was very inferior land, and we travelled the prairie without wood, depending on a scanty supply of buffalo dung, which we collected in order to cook our meals.

Absence of
wood.

Ear Hills
Grand
Coulée,
Buffalo.

Lose a horse.

After passing the Ear Hills on 24th of June, we reached the Grande Coulée, and camped near a lake three miles long and two wide, where we at length found some wood, (willow and poplar, with a few birch). We were here out of provisions, but fortunately fell in with bands of buffalo. The weather was very cold and stormy, and the rain fell in torrents. We killed, however sufficient buffalo for our present wants. Here I had the misfortune to lose one of my finest horses while cutting up a buffalo. The horse was attached to the dead bull's horn, and took fright at one of the men coming over the brow of the hill with a load of brushwood; he broke his halter and made his escape on the plain. Instantly, four of my best mounted men started in pursuit; the rain poured in torrents, driven by the storm against their faces. They continued till dark night in vain; the intrepid fellows, without a coat or a blanket with them, passed the night on the broad prairie, with not a shrub to shelter them from a terrific thunderstorm, and as soon as day dawned, took up the horse's tracks, mounted and recommenced their pursuit. ~~All their exertions, however, were in vain, for, unfortunately, the horse was a very swift powerful animal, a finer one than any in pursuit of him.~~

Delay by
sickness.

In consequence of the severity of the weather, and the great hardships the men had undergone, one of them was seized with acute inflammation of the lungs, which delayed us for eight days. This time I could hardly consider lost, as the weather continued very wet, and the horses were much in want of rest.

Guarding
horses.

We were now in the Blackfoot country and had to guard our horses strictly every night, I myself and each of the gentlemen with me keeping watch in turn, and during the daytime keeping scouts on the "look-out" in every direction.

March re-
sumed.

At length, on 3rd July, Antoine Shaw was sufficiently recovered to be removed and the Expedition continued its course to Battle River, the weather very cold and stormy, with several severe hail showers, the stones striking so hard as to cause pain to ourselves and the horses.

I will not occupy your Lordship's time with minute details of our journey from this, as the prairie was neither well provided with wood nor rich in pasture, but will pass on to the period of our arrival at the Battle River.

Battle River.

On 7th July we arrived at Battle River, a large but unnavigable tributary of the Saskatchewan, crossed the stream, and encamped in about lat. 52° N., long. 111° W. Here we found fine rich soil, well adapted for pasture and agricultural purposes. The river at this point takes a wide sweep to the south; instead therefore of continuing up the stream to the southward and then again to the northward (*i.e.* round the bend of the river), I determined on holding my direct course, and dispatched Dr. Hector with two men on horseback and one pack-horse to follow the bend of the river, and meet the Expedition again, where I proposed re-crossing the stream, about 40 miles to the westward. The Doctor reached me on the 11th, the day after I arrived at my second crossing place, having laid down that portion of the river, and fully confirmed my expectations as to the fertility of the country through which it flows. Here, also, we had seen the first pines since our departure from the north branch of the Saskatchewan, and although *now* no longer in large number, still there are indications of their having existed here in great abundance, and of a large size. Unfortunately the Indians have a most disastrous habit of setting the prairie on fire for the most trivial and worse than useless reasons. If a war party returns, if a hunting party starts, even if a single individual wishes to signal his camp, the invariable method resorted to is "firing the prairie." The result is, all their invaluable timber, such as pines and deals of every kind, perish for ever off the face of the earth, leaving nothing hereafter to spring up in their place but willows and poplars. Hence, year after year willows are sacrificed for ever, which would bring wealth, warmth, and the means of transport to the future settler, who might till the soil and navigate its streams.

Fertility of
the country.
Pines.

Effect of
prairie fires.

Cross Battle
River a
second time.
Circees.

At our second crossing place of Battle River, I was visited with great ceremony by a large camp of Circees. These Indians, though differing widely from the Blackfeet, and speaking another language, are allies to the latter. They are very poor and troublesome, and sometimes riotous and disorderly. Although, the old men and chiefs were well disposed towards us, we had reason to congratulate ourselves that our party was so strong, otherwise I do not think the chiefs would have succeeded in their endeavour to keep the young men from attempts on our horses. We spent an anxious night, all keeping watch, and the next day we made them a few presents, exchanged a few tired horses, and parted on very good terms.

Splendid soil
westward of
Battle River.

Our course to the westward from Battle River continued through a soil of fine vegetable mould two feet deep upon a substratum of sand. This portion of country was no doubt formerly forest lands, but now converted into prairie by the frequent occurrence of fires which overrun the country.

On 14th July, when nearly out of provisions, buffalo were discovered to our south at a great distance. I dispatched Mr. Sullivan with the hunters, followed by three carts to hunt, being uncertain as to whether we should again find buffalo to the westward. On the return of the carts, I gave orders to remain here a few days, to slice and dry provisions for at least ten days' consumption.

I started from this encampment in a W.N.W. direction to the Bull Lake, and left orders that the Expedition should go on their course to the Red Deer River, where I would again join them. The Bull Lake is nine miles long and seven broad, and is connected to the Red Deer's River by an insignificant stream insuing from the southern extremity of the lake. I think this lake would be a desirable place for a settlement, the soil is good, and the lake is in proximity to the Red Deer River, a large navigable tributary of the south branch of the Saskatchewan. There is, however, no valuable timber at the lake itself, but ample quantity could be obtained both at the Red Deer River and its tributary, the Medicine River, where the white spruce and rough barked poplar are in abundance.

On July 24th we camped on the edge of the woods, in lat. $51^{\circ} 52' N.$, long. $114^{\circ} 10' W.$ I determined there to await the arrival of Lieut. Blakiston, who was to join us after having gone by the regular cart track, *via* Edmonton, in charge of ammunition, flour, and a few articles for Indian presents. We waited three or four days, and with difficulty supported ourselves on deer, which were very scarce, as the Assineboines had hunted there all the spring. At length, on 29th, I directed Dr. Hector to proceed to the forks of Medicine and Red Deer rivers, and bury a letter for Lieut. Blakiston, informing him that we were obliged to move onward from scarcity of provisions, and acquainting him how he was to steer his course in order to fall on our trail.

On July 30th we again broke up camp; and, as I intended to send a part of the Expedition by the same route to winter quarters from the Rocky Mountains, I there made a "cache" of all the articles that we could possibly dispense with, in order to lighten the Expedition as much as possible, and enable us to abandon the carts for a time, hide them, and proceed with pack-horses.

All these arrangements being completed, we started at 8.30 A.M.; and as we were camped at 1 o'clock for dinner, Lieut. Blakiston, with his carts and horses, overtook us. He brought us the news that the boats had not arrived, and he was obliged to leave without the stores; but he succeeded in bringing me some ammunition from Edmonton, which, after all, was the only thing of vital importance.

We were now without provisions, but still continued our course. In the evening, however, two of my scouts came into camp, and reported a large band of buffalo about twelve miles to S.E. The next morning we started before sunrise, and travelled till 9 o'clock, when we came within hearing-distance of the tramping of the animals. Here we camped, saddled the runners, and started after our game: we had an admirable run, and killed sixteen. All hands then went to work to prepare and dry meat for the period that we should travel among the Rocky Mountains; because I was aware that, once we entered that range, we should have little or no chance of finding anything to eat. We all worked hard slicing and drying, made our provisions, and were ready to start on 4th August.

As I had ample time before the close of this season to seek for the pass, the existence and place of which I was in search of, I determined to ride to the boundary line and examine the country from the mountains eastward, and took with me Mr. Sullivan. I left Dr. Hector and Lieut. Blakiston, and M. Bourgeau, to proceed to the Old Bow Fort, or Chesterfield House, with the main body of the Expedition under charge of Dr. Hector, with orders that, as soon as they had arrived at the site of the Old Fort, he should place the carts in "cache," dispatch the gentlemen on their different missions, proceed upon his own, and direct the remainder to await my secretary's return from the boundary line: M. Bourgeau to enter the mountains and proceed with three men and seven horses on a botanical exploration, wherever he thought best; Dr. Hector with another party, to go on a geological tour; Lieut. Blakiston to proceed through the mountains by the two known Kootanie passes, returning by the southern one.

I started at noon from our camp, known as Slaughter Camp, lat. $51^{\circ} 20' N.$, long. $113^{\circ} 45' W.$, and kept on a southern course along the prairie. We only found salt lakes; and though we rode till 11 P.M., we camped without fire or water, but next morning reached the Lower Saskatchewan or Bow River, in lat. $50^{\circ} 55' N.$ We crossed the river after breakfast, found it very deep, our horses as well as ourselves being obliged to swim. The country we passed over on the north side of the river has a wretched soil; but when on the south side, the appearance and soil changed greatly for the better. We crossed numerous well-wooded rivers,—many of them containing valuable timber, such as

Halt to make provisions.

Bull Lake.

Cache Camp. Send to meet Lieut. Blakiston.

Start again.

Lieut. Blakiston's arrival.

Buffalo.

Arrangements for exploration.

Slaughter Camp. Start for the boundary line.

Nature of country.

Cypres Hills.

pinces, spruce, &c.,—the valleys and neighbouring soil of which were rich and desirable for cultivation; but whenever we struck out on the broad prairie, we generally found the soil worthless, except here and there in small swamps. Although my journey to the western extremity of the boundary line was necessarily a rapid one, I determined on a visit to the "Cypres Hills." I was anxious to see this part of the country, in consequence of having heard many reports of its wonderful timber and fine rich soil. I found great tracks of splendid timber wasted by fire; there still remains, however, many valuable pines, and the land is rich and capable of producing several grain crops in succession without manure.

Reach boundary line.
Its locus.
Chief Mountain.

On August 8th, we arrived at the 49th parallel, the prairie stretching to the east, utterly devoid of wood save in the valley of the Great Belly River. The locus of 49th parallel is very strongly marked by a high prominent mountain, called the Chief's Mountain, in full view of which the Indians meet in the autumn, and perform some characteristic dances. I only remained one day, which I devoted to riding in an easterly direction, and climbing elevations to obtain an extensive view of the country to the east, but saw nothing but prairie of the poorest kind, and destitute of timber. The next day I arrived late in camp, and we started for the Old Bow Fort, where we arrived on 14th August.

Old Bow Fort.

The site of the Old Bow Fort is in lat. $51^{\circ} 9' N.$, long. $115^{\circ} 4' W.$, at the foot of the Rocky Mountains. The chimneys of the place are still standing. The Hudson's Bay Company have long abandoned the post, many of their servants having lost their lives in its defence. Although the timber here, consisting of fine prush, Banksian pine, spruce and red pine is valuable, the soil is scanty, the river valley being occupied by immense deposits of shingle.

Scarcity of game.

On my arrival at the Bow Fort I found my hunters waiting for me. They had been out in every direction, but could not fall in with buffalo; they had also found elk and deer very scarce. In addition to this, they were in great fear of the Blackfeet and Blood Indians, whose return from the south-east would soon be daily expected. I was therefore obliged to alter my plans and desire them only to await the arrival of M. Bourgeau, and afterwards to proceed to the forks of Red Deer and Medicine rivers, and there to await the return of Mr. Sullivan, whom I was to send in charge of my branch expedition as soon as I had searched for my pass back from the mountains, I myself proposing to proceed westward to meet Captain Hawkins and visit Vancouver. I regret, however, that a letter from Lieut. Blakiston was handed to me by one of my men acquainting me, that "his position in Her Majesty's service would not allow of his considering himself in any way connected with the Exploring Expedition under my command."

Resignation of Lieut. Blakiston.

Derangement of my plans.
Start to explore the mountains.
Kananaskis River.

This step of Lieut. Blakiston deranged my plans a little, and is partly the reason why I have determined on wintering on this side of the mountains.

On the 18th of August I started to seek for the new pass across the Rocky Mountains, proceeding up the north side of the south branch of the Saskatchewan or Bow River, passing the mouth of Kananaskis River. Five miles higher up we crossed the Bow River and entered a ravine. We fell upon Kananaskis River and travelled up it in a south-westerly direction, and the following day we reached Kananaskis Prairie, known to the Indians as the place "where Kananaskis was stunned but not killed." On the 21st we passed two lakes about two miles long and one wide. We continued our course, winding through this gorge in the mountains among cliffs of a tremendous height, yet our onward progress was not impeded by obstacles of any consequence; the only difficulty we experienced was occasioned by quantities of fallen timber caused by fires. I observed that many, indeed most of these tremendous fires are caused by lightning, and in one or two places traced their progress where the foot of man could never have trod.

Reach height of land.

Altitude of the only obstacle.

Fallen timber.

Columbia Lakes.

On the 22nd of August we reached the height of land between the waters of Kananaskis River and a new river, a tributary of the Kootanie River. We remained here for the rest of the day, occupied with observations. Our height above the Bow Fort was now 1,885 feet, or above the sea 5,985 feet. Next morning we commenced our descent, and for the first time we were obliged to get off and walk, leading our horses down a precipitous slope of 960 feet over loose angular fragments of rock. This portion over, our route continued for several days through dense masses of fallen timber, destroyed by fire, where our progress was very slow, not owing to any difficulty of the mountains, but on account of the fallen timber, which we had first to climb over and then to chop through to enable the horses to step or jump over it. We continued at this work from daybreak till night, and even by moonlight, and at length reached the Columbia Portage on the 27th of August. Here I devoted a day to ascending some heights in search of a view of the Columbia River. After climbing several mountains in rain, I at last was astonished to find myself right upon the bank of the lake from which the Columbia rises, at a height of about 2,300 feet over the surface. Climbing a high tree in order to overlook the woods which inter-

cepted my view, I saw both the Columbia lakes, the Columbia rising out of the southern, flowing into the northern one, out of which it bends to the westward previous to taking its northern course to the boat encampment. The most southerly of these lakes is in lat. $50^{\circ} 7' N.$, long. $115^{\circ} 50' W.$

On the 30th of August we arrived in lat. $49^{\circ} 36' N.$, long. $115^{\circ} 37' W.$ on the Kootanie River, where we found a camp of Kootanie Indians. These are the most wretched-looking fellows I ever met; men, women, and children, all living on berries, the men naked and the women nearly so; yet strange to say they possess a wonderful number of horses, and those very superior to the Indian horses on the east of the Mountains. Although these people were starving and destitute of clothes and ammunition, still they possess an enormous quantity of very fine horses. Yet I had considerable difficulty in training horses for the Expedition, and those I did succeed in training were not from among their best horses, neither could I obtain more than one or two horses for mere trade, although they were most anxious to exchange horses even greatly to their own disadvantage.

I had eleven horses with me. Most of them were in wretched condition, and many of them worn-out, unserviceable animals, yet these were eagerly exchanged and good ones given in their stead, particularly when a little present of two plugs of tobacco and fifteen balls and powder were advanced. Indeed, only for my having effected these exchanges of horses I hardly think I should have succeeded in bringing back all the horses I had started with from the Old Bow Fort, some of which had also been with me on my previous rapid trip to the boundary line.

I learned from the Kootanies that there was a very plain easy road to Fort Colville, distant eight days from their camp; but as they had quarrelled with the Flat Heads, not one would volunteer to come with me as guide. However, that circumstance would not have deterred me from proceeding westward to meet Captain Hawkins and visiting Vancouver, had I known what Lieut. Blakiston's intentions were, and, indeed, it was not until after his return to Edmonton that he could communicate them to me. I merely state them without note or comment.

On the 11th August Lieut. Blakiston resigned his place in the Expedition; Lieut. Blakiston then took three men, an Indian guide, and ten horses belonging to the Expedition, when no longer an officer of the Expedition. This irregular proceeding I pointed out to Lieut. Blakiston, but said I would let that pass. However, on requesting Lieut. Blakiston for the map of his route through the two Kootanie Passes, I was surprised by a positive refusal to give me any maps, or the benefit of any observations whatever.

I have nothing further to write on the subject, save to submit Lieut. Blakiston's letter of 11th August 1858, which I have the honour to enclose.

On September 6th I started to re-cross the mountains by the Kootanie Pass, and was surprised to find that pass also within the British territory.

We entered it in lat. $49^{\circ} 11' N.$, long. $115^{\circ} 21' W.$ in the valley of the Elk River, and came out on the east side of the mountains in lat. $49^{\circ} 32' N.$, long. $114^{\circ} 35' W.$ in the valley of Little Belly River. It is one frequently used, but not the general pass of the Kootanie Indians, who have a preferable one in the American territory.

On September 7th we passed the height of land, a formidable ascent, where we had to walk and lead the horses for two hours. This is the height of land which constitutes the watershed. We encamped for the night in a small prairie, after making a considerable descent. On the 8th of September our course continued through woods and swamps, for about 15 miles, till we arrived at another ascent; this was also a severe ascent, though not so formidable as that of the day previous; we reached its summit about four o'clock, through a severe snowstorm, the snow falling so fast as to make me very apprehensive of losing the track. We descended that evening, and camped on the eastern side, and next day arrived at the eastern extremity of the pass. I regret that I cannot give the altitudes on this pass, as our barometer was broken by one of the horses. It is, however, far from being so favourable as the more northern one by which I entered on Kananaskis River, which has but one obstacle in height of land to overcome, and where the whole line of route is free from swamps and marshes.

I will not take up your Lordship's time with an account of our journey from the Kootanie Pass to Edmonton, as I have given a description of the greater part of the country already.

I have great pleasure in reporting the arrival of Dr. Hector while I have been writing this letter. I have been very anxious about him, knowing how badly off he must have been for provisions. He has had a very severe journey, and much trouble in

Meet with the Kootanies.

Trade horses.

The road to Colville.

Ignorance of Lieut. Blakiston's intentions. Statement concerning Lieut. Blakiston.

Enclose copy of Lieut. Blakiston's letter. Start to re-cross the mountains. British Kootanie Pass.

Height of land.

Aneroid barometer broken.

Arrival of Dr. Hector.

He has laid down the Saskatchewan.

Enclose his report.

His route. Double watershed.

On the practicability of a railroad.

The water-line not identical with the geological axis.

Recommendation of instructions.

Mode of return. Economy of Western route. Sale of horses.

Expenditure.

1,200L. more required.

Possible objection.

finding game enough to support himself and party. He has amassed a large stock of information in the mountains, geographical as well as geological. He is very anxious to penetrate further across to the west, but unfortunately my instructions prevent me from permitting him to do so, however desirable I might consider such a journey to be. In addition to being an accomplished naturalist, Dr. Hector is the most accurate mapper of original country I have ever seen, and is now an experienced traveller. By long and severe journeys with dogs and snow shoes last winter, in connexion with his hard trip this autumn, he has laid down the whole north branch of the Saskatchewan, and the south branch from where we met it to the glaciers of its source; and there is no department of the Expedition in which he is not only competent, but willing to assist.

I have the honour of enclosing Dr. Hector's report of his explorations, and there are two facts connected with that portion of country to which I wish particularly to draw your attention.

1st. Dr. Hector followed the Bow River right up to the main watershed of the continent, then followed it until he reached a transverse watershed, which divides the waters of the Columbia and those of the north Saskatchewan on the one hand, from those of the Kootanie and south branch of the Saskatchewan, on the other. There he found the facilities for crossing the mountains so great, as to leave little doubt in his mind of the practicability of constructing even a railroad connecting the plains of the Saskatchewan with the opposite side of the main chain of the Rocky Mountains.

2nd. Dr. Hector informs me, that the water-line of the mountains is not identical with their geological axis; this axis he was unable to reach, and had only opportunity of examining what are called flanking ranges, therefore the most important geological results relating to the Rocky Mountains of North America remain as yet unascertained, because, in conformity with my instructions, I was obliged to order Dr. Hector not to advance further than the axis of the watershed of these mountains; and I take this opportunity of recommending Her Majesty's Government to alter that part of my instructions, and direct my movements in the following manner:—That, as soon as my explorations are completed on the east side of the mountains (for now there remain only 6° of longitude in the country of the boundary line), I should send Dr. Hector to complete his exploration, and then meet me at Fort Colville, whence we could return home to England by Panama, and the British West Indian mail steamer from Chagres, a far cheaper route than recrossing the whole continent of North America. Besides this, it will enable me to dispose of all my horses to great advantage, and even make money to credit side of the Expedition in the account for horses. The Hudson's Bay Company are very short of horses, and allow me 20L. each for 25 horses now, and have promised to purchase all the others I can spare next year. I have now 53 horses, almost all of which are sure to outlive the winter; I have lost but three or four this year, and may lose five this winter; however, I have not neglected any precaution in my power, and have cut and stacked hay for them, and am constructing a shelter for those that may require it after Christmas.

As to my expenditure this year, it is not easy to give an exact statement, as the accounts are all priced at La Chine, and I am too far distant to go down and settle them, as I did last year. They will, however, hardly exceed 2,000L. by more than I can counterbalance by the sale of the horses. The expenses of next season will exceed 1,500L. if anything at all is to be done. But if Her Majesty's Government are really apprehensive of the grant of 1,500L. being overdrawn, I have but one course to pursue, that of abandoning the completion of the boundary line, and all discoveries in the Rocky Mountains, and returning home in the beginning of the season. It is quite true that my expenses for this financial year will not have been so great as those for the financial year 1857-8; but any one acquainted with this expensive country will inform Her Majesty's Government that 1,500L. is hardly sufficient to cover a season's explorations, particularly when the salaries and home journey expenses are to be deducted from it.

I feel greatly honoured by the confidence Her Majesty's Government have hitherto placed in me, and should Her Majesty's Government consider the importance of ascertaining the practicability of a railroad across the Rocky Mountains, as well as a more extended acquaintance of the geological structure of those mountains themselves, worth the further sacrifice of a few hundred pounds, I would propose that the Government grant me the whole of the 1,500L. for expenses in this country alone for the next season, independent of salaries and the homeward travelling expenses, the former of which will amount to 570L., and the latter, I hardly think, will exceed an equal sum, if I am allowed to adopt the route I propose as most conducive to the interests of science as well as the purposes of economy. The only objection that can be urged to this proposition is, that Captain Hawkins and his party have been sent to the west side of the

mountains. But their work, as far as I understand, will confine them to the neighbourhood of the 49th parallel, and they will not have the same facilities for accomplishing those objects as I shall, starting from the eastward in a higher latitude, where the country is safe and a small party can travel, nor could they effect them as rapidly and economically as I could.

My plan is to send Dr. Hector to pursue his discovered route, which my instructions compelled him to abandon, while I and my secretary, Mr. Sullivan, will follow a different line of traverse to the Pacific, so as to ascertain as much as possible of the nature of the country lying between the mountains and the sea north of the 51st parallel.

M. Bourgeau, who has made a magnificent collection of Alpine plants during his tour in the mountains, will return to London, *via* Pembina and St. Paul's, in order to fulfil his botanical engagements for 1860. I have to express my thanks to him for his most unceasing exertions, not only in his botanical labours, but for his zeal and care as manager of the provisions and stores of the Expedition, and his anxiety to assist me in every possible way.

I have also to express my satisfaction with my secretary, Mr. Sullivan, not only for his zeal and assiduity in carrying on the astronomical observations, but also for his assistance and exertions for the interests of the Expedition, particularly with regard to the horses; also by his care and regularity with the accounts, which, in a country where everything is conducted on a system of "barter," are of a very complicated nature.

I have the honour to enclose two maps.* The first contains the routes of the whole Expedition, together with those of the branch parties. The other is a rough enlargement of a portion of this, in order to display with greater clearness our different routes of exploration while in the mountains. The map is not final as regards the mountains, as Dr. Hector's longitudes are by account, and may require correction; the remainder, however, is completed, and I beg it may be preserved, as we have no time to make a copy.

We have barely returned from the plains into Fort Edmonton in time to receive and answer our letters by the "fall boats," which start again immediately after they are unloaded, to anticipate the setting in of the ice. Our time, therefore, is very short, and although I have troubled your Lordship with a long letter, yet I have been obliged to omit a great deal of information contained in the journal.

Fort Edmonton is the largest trading post in the Saskatchewan; a little agriculture is carried on; they grow tolerable wheat, and grind it in a windmill. The potatoes are excellent, and horned cattle continue out the whole winter, and still are thriving. However, I cannot observe much as yet; my whole time has been occupied with the men's accounts and the correspondence.

The Red River men return to Carlton by the boats, where I have made arrangements for their conveyance to Red River Settlement, and give them the balance of their pay in orders on the Hudson's Bay Company. The Lake St. Ann's men are paid in goods, as money is not known in this country, and I am now giving them value for their wages in goods ordered by me for the Expedition, charging them the Company's prices. It would be impossible to send an account down now, but I will forward one by the winter express, along with the whole corrected map of the Expedition, and the observations.

I must now beg leave to draw your Lordship's attention to that portion of my original instructions of March 31, 1857, which direct me as follows:—

"You will endeavour from the best information you can collect to ascertain whether one or more practicable passes exist over the Rocky Mountains within the British territory, and south of that known to exist between Mount Brown and Mount Hooker."

In accordance with these instructions, I first obtained the best information I could collect, which proved so vague as to be utterly valueless. I then directed Dr. Hector to undertake the more northern search (*i.e.* between the two branches of the Saskatchewan River), I myself, accompanied by Mr. Sullivan, undertook the search from the south branch of the Saskatchewan to the pass of the probable existence of which I had informed Her Majesty's Government before receiving the command of the Expedition. I directed Lieut. Blakiston to undertake the Kootanie Passes supposed to be in American territory. Lieut. Blakiston threw up his command in order to carry out that object independent of me, but with the assistance of Mr. Sullivan, I was also able to effect that portion of what was to have been his duty myself. This comprised the southernmost pass

Plans for next year.

Botanical collection.

M. Bourgeau.

Mr. Sullivan

The maps.

Great haste.

Fort Edmonton.

Red River Brigade.

St. Ann's Brigade.

My original instructions.

Vagueness of Indian reports.

Summary.

* The maps have been reduced and incorporated into the long map, which will be found at the end of these Reports.

within the British territory. Lieut. Blakiston's exploration may perhaps have a value hereafter as a corroboration of my own.

Indian
knowledge
of the moun-
tains inade-
quate.

Desirable
that explo-
ration con-
tinue.

Enumeration
of discovered
passes.

The fact is that the knowledge the Indians possess of the mountains is very small, even among those said to "know the mountains," their knowledge is very limited indeed. This is easily accounted for by the scarcity of the game, which offers no inducement to the Indians even to go there. I fear if Dr. Hector leaves this country without completing his pass, much difficulty might arise hereafter in finding the exact point of the western exit of the valley, as it is very small and the woods dense, and no one could find it as the Doctor himself. Besides, the most unfavourable result would even be desirable in that case, as it would set the question of the possibility of the easy construction of a railway across the Rocky Mountains for ever at rest.

I will now enumerate the several passes which have been discovered and laid down.

1st. From south branch Saskatchewan to Kootanie River:

Two, *i.e.* Kananaskis Pass and Vermillion Pass:

2nd. From Kootanie River to Columbia:

Two, *i.e.* the Lake Pass and Beaver Foot Pass.

3rd. From south branch Saskatchewan to north branch:

One, *i.e.* the Little Fork Pass.

4th. From south branch Saskatchewan to Columbia:

One, *i.e.* the Kicking Horse Pass.

British
Kootanie
Pass.

Captain
Hawkins.

In addition to these discovered passes, the Northern Kootanie Pass has been laid down, and found to be entirely within the British territory, and I have named this the British Kootanie pass.

With regard to the expressed wish of Her Majesty's Government that I should communicate with Captain Hawkins, I beg to state that I shall endeavour to find an opportunity of doing so.

In conclusion, I have to acknowledge the receipt of your Lordship's courteous expressions on the subject of my letter of 13th March 1858. I have also to acknowledge the receipt of the abstract account for the financial year 1857-58.

I have, &c.

(Signed) JOHN PALLISER, Capt. Waterford Artillery Militia,
Commanding N. British America Exploring Expedition.

The Right Hon. Lord Stanley, M.P.

&c.

&c.

&c.

Enclosure 1
in No. 8.

Enclosure 1 in No. 8.

Sir,

Fort Edmonton, Saskatchewan, October 9, 1858.

I have the honour to report the safe arrival of myself and party at this place on 7th current, being exactly eight weeks from the time of our separation from the remainder of the Expedition.

After your departure to the boundary line on August 3, according to your instructions I conducted the Expedition without loss of time to the site of the Old Bow Fort, and arrived there on the afternoon of the 7th. On the 5th we began to ascend considerably, and saw the last of the real plains. From this point our way lay over a succession of parallel ranges of hill, wooded in some parts to their summits, but not rising to more than 800 or 1000 feet above the plain. On the morning of the 7th, we first struck the south branch of the Saskatchewan at the mouth of Dead Man's River, and from this point, we followed it up until we reached the Old Fort on the same day. Its site is marked only by a group of mud and stone chimneys, the remainder of the fort having been constructed of timber, all of which has long ago been removed and used by the Indians as firewood. A small stream joins the river from the west at this place, and the main stream itself makes a bend from a north to an easterly course.

Our camp was pitched within three miles of the mountains, which rose behind as ranges of bald inaccessible cliffs to the height of from 3,000 to 4,000 feet above the eye.

We fortunately met with a large camp of Assineboines at this place, from whom I traded pack saddles and other articles which were required for our mountain work.

In conjunction with Lieutenant Blakiston, observations were made on the temperature of boiling water, to determine the altitude of the place, and to find the errors of our aneroids. The corrected mean readings for the time of our stay compared with the mean for Carlton, showed the altitude above that place to be 2,225 feet, or above the sea 4,100 feet. Our aneroids, and also the sympiesometer for great altitudes, I am glad to say, still gave a very close approximation to true readings, notwithstanding the great increase of elevation.

On 11th August M. Bourgeau and I started and camped together about 11 miles up the valley of Bow River, on the banks of a lake formed by a dilatation of the river in consequence of the valley being barred by immense deposits of rounded shingle. Our road was rather a bad one, on account of the fallen timber which impeded our path, the valley not having been frequented by the Indians for many years.

This first portion of the valley cuts through five parallel ranges of mountains at right angles to their axes. These are composed of beds of crystalline and compact fossiliferous limestone (most likely of

carboniferous age) dipping at 30° to W.S.W., but having several obscure plications. Two well marked peaks occur on either side of the valley, which M. Bourgeau named "Grotto" and "Pigeon" peaks.

After passing the former of these, the following morning (having taken leave of M. Bourgeau, who remained to examine this mountain) I entered a wide trough-like valley, running to S.S.E., through which I contrived to follow up Bow River in the opposite direction for three days. This trough continues to run through the mountains, beyond the points where the river leaves and enters it, the latter being between "Cascade" and "Rundle" Mountains.

"Cascade" Mount which is known to the Indians as the "place where the water falls," rises as a series of precipices to the height of 4,521 feet above a small level plain at its base, and is so abrupt that its summit is in view at a horizontal distance of 2,200 yards. It may be taken as a type of the mountains in this portion of the chain, all being equally precipitous and inaccessible.

Bounding the valley to the south is the "Windy" Mount of M. Bourgeau, which he has made the subject of an elaborate botanical examination.

From the Cascade Mount the river valley again changes its direction, passing at right angles to the chain so as to cross the "Saw-back" range, which are composed of the same strata as before, but now almost vertical, having only a slight inclination to W.S.W.

After following up the valley which then was reached, to N.W. for three days, on the 18th I arrived at "Castle" Mount opposite the entrance to the "Vermillion" Pass. I had already passed three small tributaries, by following up either of which, the height of land can be crossed to the Kootanie River, but judging from Indian report, none of these were so promising as this one, by which I now resolved to cross the water-line of the mountains.

The mountains now began to wear a different aspect, more massive, and evidently much loftier. They are composed of white and pink quartzose sandstone, almost passing into a quartzite in some parts, and in others into a fine conglomerate. Their minute description, as well as other geological points, will, however, form the subject of a more special report.

Having devoted a day to the examination of Castle Mount, and to prepare the flesh of a moose we had killed, on the 20th I crossed Bow River, without swimming the horses and unloading their packs; and, after a six hours' march through thick woods, reached the height of land the same afternoon.

By careful barometric readings I found the rise from the river to be 539 feet; and I consider the rise of the river, to where I crossed it from the Old Bow Fort camp, to be 300 feet, thus giving for the height of land 940 feet. The small stream along which we had ascended here ends in two small lakes, the water of which is beautifully clear; and 200 yards further on, and at 17 feet above the level of the upper lake, we came on a rapid turbid stream, flowing to the S.W., which was the head of the Vermillion River, the principal branch of the Kootanie River.

The height of land is in $51^{\circ} 8' 30''$ N., longitude by account $116^{\circ} 35'$ W. It is in a wide valley, between outlying shoulders of two snow-clad mountains, which I named after Mr. Ball and Colonel Lefroy, the latter being to the west. The ascent to the watershed from the Saskatchewan is hardly perceptible to the traveller, who is prepared for a tremendous climb, by which to reach the dividing ridge of the Rocky Mountains, and no labour would be required, except that of hewing timber to construct an easy road for carts, by which it might be attained.

The three following days were occupied in the descent of Vermillion River, which, after flowing to S.W. by W. for nine miles, suddenly changes its course to S.E. for 18 miles, when it again changes to S., escaping into a wide valley to join a much smaller stream, which is the Kootanie River.

In its course of about 40 miles it descends 1,227 feet, so that at its junction with the main stream it is 383 feet below the Old Fort.

It becomes of considerable size a very short way from its source, as it receives large tributaries from glaciers which occupy the valleys of Mounts Lefroy, Ball, and Goodsir. The valley through which it flows is contracted only at one point "The Gorge," near its lower part, where two lofty mountains seem to close in on the stream, without, however, in reality causing any great difficulty in passing along its base.

A road for carts down the valley of Vermillion River, from the height of land to the Kootanie River, could be cleared without difficulty, for, supposing the road to follow a straight line along the river, and the descent to be uniform, which it almost is, the incline would only be 40 feet in a mile, or 1 in 135.

The absence of any abrupt steps, either in the ascent or descent, together with the small altitude to be passed over, form very favourable points in the consideration of this pass as a line of route.

There is some confusion as to which is called the Vermillion and which the Kootanie River in the accounts given by Indians, so I have thought it better to confine the former name to the large stream by which I descended, and consider the smaller stream into which it flows as the Kootanie River. This accords better with nature of the valleys, as the Kootanie River, although an insignificant stream, before receiving the Vermillion River flows S.E. through a magnificent valley from three to five miles in breadth.

The forks of Kootanie and Vermillion River are in lat. $50^{\circ} 50'$ N. long. by account $116^{\circ} 40'$ W. (I may state that, in reference to all my longitudes, I did not trust to the reckoning by distances travelled alone, but obtained them by a system of bearings, combined with numerous observations for latitude.)

I should have liked very much to have descended the Kootanie River for some distance, to find if there is any gap in its valley by which a passage could be effected to the west without following down the stream; but my orders to confine myself to the water-line of the mountains, and which required me to be back at Fort Edmonton early in October, limited me to a less extended circuit in the mountains than I should then have required to make; besides, judging from the absence of all tracks since leaving the valley of the south branch, there did not seem to be the slightest prospect of procuring game on the west side of the watershed, and we were now beginning to be pinched for provisions.

Ascending the Kootanie River, therefore, on 27th, I reached the height of land which divides it from one of the principal tributaries of the Columbia River, called Beaver Foot River. The watershed is in a large morass, with several lakes occupying the bottom of a deep wide valley, common to the two streams, although flowing in opposite directions. The line of watershed is so little marked that it is impossible to cross even on foot between the two streams without going in water. On either side of it

the stream is dilated into wide shallow lakes, the surfaces of which were crowded with the gaudy flower of the *Nuphar lutea*. The altitude of this watershed I considered to be 3,834 feet above the sea, or 266 feet below the Old Fort.

It is on 51st parallel of latitude, in longitude $117^{\circ} 10' W$. On the north side of the valley are Mount Goodsir and Pyramid Mountain, and on the south is the Brisco range, which although of no great elevation (about 2,000 feet above the eye) run, as an unbroken wall, to S.S.E. My Indian declared that the river we had now struck was the head of the north branch of the Saskatchewan, and wished to follow it down, but if my barometer and sympiesometer were acting with any approach to accuracy we were now about on a level with what I had found to be the elevation of the Mountain House during last winter, so that this could not be the case. In addition, the change in the vegetation, especially the occurrence of cedar, convinced me that we were really on a branch of the Columbia.

I accordingly only followed it for two days, and on 29th reached the mouth of a large tributary, to N.W. This river is much larger than the Vermillion River, and about four times the size of the stream into which it flows, being about equal to the south branch at the point when we left it.

Here I received a severe kick in the chest from my horse, rendering me senseless, and disabling me for some time. My recovery might have been much more tedious than it was, but for the fact that we were now starving, and I found it absolutely necessary to push on after two days.

Where it receives Beaver Foot River, Kicking Horse River bends back on itself, including an angle of only 20° , and after passing over a fine fall of about 40 feet flows on to N.W.

The mouth of Beaver Foot River is about 318 feet below the height of land where we first struck it.

As I was quite unable to move, I sent my interpreter, Peter Erasmus, to ascend Mount Hunter, which is included in the angle of Kicking Horse River. He ascended for 3,496 feet, and obtained a view, to the west, of snow-clad peaks as far as the eye can reach. Over the tops of Brisco's range, and all to the left of S.W., he could perceive no mountains, so that if that portion of country is occupied by any they must be of very inferior altitude.

It was my intention to have crossed Brisco's range on foot, but my unfortunate accident quite unfitted me for the task.

The angle of Kicking Horse River is in lat. $51^{\circ} 10' N$, long. $117^{\circ} 26' W$.

While traversing this valley, since coming on the Kootanie River, we have had no trail to follow, and it did not seem to have been frequented by Indians for many years. This makes the absence of game all the more extraordinary. The only animal which seemed to occur at all was the panther. The Indian saw one, and in the evenings we heard them calling, as they skirted round our camp, attracted by the scent.

The bottom of the valley is occupied by so much morass, that we were obliged to keep along the slope, although the fallen timber rendered it very tedious work, and severe for our poor horses, that now had their legs covered by cuts and bruises.

The timber along Beaver Foot River is mostly young, but there are the remains of what had been a noble growth of forests, consisting of cedar, pines, and spruce, among the latter of which is the magnificent prusche, which sometimes reaches four yards in circumference. I also saw a few young maples (*Negundo fraso*). Berries of many kinds were very abundant, and, indeed, had it not been for this we would have suffered much from hunger.

On 31st August we struck up the valley of Kicking Horse River, travelling as fast as we could get our jaded horses to go, and as Leould bear the motion, and on the 2nd Sept. reached the height of land. In doing so we ascended 2,021 feet. Unlike the Vermillion River, the Kicking Horse River, although rapid, descends more by a succession of falls than by a gradual slope. Just before we attained the height of land, we ascended more than 1,000 feet in about a mile, down which the stream leaps by succession of cascades.

This height of land is 5,120 feet above the sea, and is lat. $51^{\circ} 24' N$, long. $117^{\circ} 20' W$. The water-line is in a flat valley, clothed with fine open forests of spruce, lying between Mount Vaux and the eastern end of the Waputteehk Mountains.

Here, to our great joy, we found tracks of game again.

On the morning of the 3rd, we followed down a small stream over a wooded plain for about six miles, and only descended about 50 feet from the height of land, when we came to a large river, flowing to S.E., which the Indian at once recognized as the south branch, from which we had been absent about two weeks.

The same afternoon he killed a moose, which relieved us from want, and we also fell in with a band of Assineboines, who had just come over by a direct pass from the north branch to this place.

We had several days of severe weather at this time; a great deal of snow with thunderstorms. I delayed here with the Indians on account of our horses requiring rest, and also to get them to dry our moose-meat properly for us, as we lost more than half of the last from its not being well prepared.

On 8th September I started to ascend the south branch, not following the pass by which the Indians had come, and which they described as very easy, but to endeavour to pass from its head waters to those of the west branch.

All the mountains on both sides of us were now snow-clad; and those on the south side having their valleys occupied by glaciers, some of great size.

In two days we reached the height of land by a gradual ascent. Here the south branch issues from a lake about four miles long, the upper end of which is fed by a glacier which descends from a magnificent *mer de glace*, occupying the elevated valleys of Mount Balfour. There is a small stream, however, which flows into this lake from a fine plain which forms the upper of the valley. Following up this, we come to where it rises from a group of springs, and, a few yards further on, a second group gives rise to the waters of the north branch. We dined at this watershed, which is the highest point we passed over with the loaded horses, being 6,347 feet above the sea. Snow was lying under the shade of the trees, notwithstanding the clear midday sun. Lat. $51^{\circ} 40' N$, long. $117^{\circ} 30' W$.

The first part of the descent from this height of land was a great contrast to our ascent of the south branch to reach it; for, in the course of two miles, we had descended about 1,000 feet.

Four miles from the height of land, the small stream which originates there receives a large branch from S.E., which, as it rises in a glacier, descending from the same *mer de glace*, as that which feeds the lake at the head of south branch. This feeder of the north branch I called the Little Fork: it flows to N.W. through a rugged valley between Mount Murchison and Mount Balfour. The former of these, which is a most massive mountain, the Indians consider to be the highest of all the Rocky Mountains.

I afterwards measured two of its highest peaks, the one above the angle of the main river and the little fork, the other to the south of the Kootanie plain, on the main river. They are, respectively, 15,789 and 14,431 feet above the sea. I hope I may have yet an opportunity of visiting Mount Brown and Mount Hooker, so as to obtain their altitudes relatively to Mount Murchison. The great size of these mountains, some of which are formed of groups 60 to 80 miles in circumference, prevents the proper appreciation of their altitude; besides not only here, but all through that portion of the range I have seen, there is an absence of striking peaks.

From the point where I met the north branch, I ascended to the place known to the Indians as the "Ice," and from which the largest fork of the north branch rises. The river is large at this place, and flows through a very wide valley, winding through shingle beds which must be covered by every spring flood, as they are clothed by a matting of *Dryas integrifolium*, *Epilobium alpinum*, and other Alpine plants, the seeds of which have been carried down from their natural habitats by the mountain torrents,

It occupied two days to ascend to the foot of the great glacier; but one of these was occupied in cutting a road through fallen timber along the banks of the Glacier Lake. This lake is about seven or eight miles long, and about four wide, and is formed by the damming up of a narrow valley between Mount Forbes and Mount Lyell.

The upper part of this valley is occupied by glaciers communicating with immense fields of ice which cover the mountains all round it. The foot of the glacier is about 4,320 feet above the sea. It is easy of ascent, as it terminates by a rounded slope, to reach which, from the floor of the valley, I had only to scramble over the series of moraines which lie in front of it. That portion lying within the valley is about five miles long and three wide; it is 600 feet deep at its lower part, but its surface at the upper end is 1,560 above the valley at its base. It is fed by a narrow spout-like glacier from the *mer de glace* above. I ascended Sullivan's Peak to the north of it, having an altitude of 7,858 feet, and obtained a splendid view of the immense mass of ice which envelopes the mountains to the south and west, obliterating all their valleys.

The stream which issues from the Glacier Lake is much larger than either the main fork or the little fork. The former of these two I ascended for some distance, and saw that it took its rise in the glaciers of a mountain to S.S.E. Up this river there is said to be a pass direct to the Columbia, which was the one first used by trappers in the time of the North-West Company, as far as I could make out from the accounts of the Indians. Mount Forbes, which lies between the Glacier Lake and the great fork of the north branch, I found to have an altitude of 13,400 feet.

Descending the valley of the north branch as it sweeps round the base of Mount Murchison, on the 16th, I reached the Kootanie plain, where the valley becomes much expanded, and is occupied by fine level plain, free from wood, like true prairie. This spot is famous among the Indians for the abundance of game, but it had been well hunted during the summer, so that there was now none left. Buffalo at one time were very numerous here, and their bones and dung showed that this must have been not many years ago. I remained here a few days to examine the mountains, which * the valley. * Sic. One to the west of the plain I ascended, and found to be 8,913 feet above the sea. On the east side of the valley is what I consider to be the continuation of the Saw-back range, so that the Kootanie plain lies in the same trough-like valley of the mountains as that in which Castle Mountain stands, and which is continuous to the north-east of Mounts Richardson and Murchison.

While resting here the Indian shot some of the big horns, the meat of which, when fat, is certainly the finest of all animals in the country. They occur only along the outer range of the mountains. The rams alone frequent the high portions of them, and the ewes keep by the river margins, especially where craggy. The true animal of the mountains is the white goat, which always keeps at high altitudes, and is only met with toward the axis of the chain. It never descends into the valleys, summer or winter, except at certain places, to eat a kind of white clay, which occurs among the recent deposits in the valleys of the mountains.

The valley of the north branch cuts through the mountains more directly than that of the south branch, and is accordingly much shorter.

Throughout it is very much wider than the valley of any other river I have seen in the mountains, and it is skirted by terrace levels consisting of deposits of shingle, white calcareous clay, and sand the whole way up to the great fork. Its descent is not great, amounting only to 300 feet from the glacier lake to where it issues from the mountains. Having passed a large tributary from the north, which I named Waputtechk or "White Goat" River, I passed out of the mountains on the afternoon of the 18th, after having been 38 days travelling in them. The following day we arrived at Big Horn river, where I determined to give my horses a week's rest, as they were so reduced as to be quite unfit for the long trip which still remained before reaching Edmonton. The feeding along this tributary of the Saskatchewan which enters it between the main chain and Brazeau's range is exceedingly fine, consisting almost entirely of vetches. Besides, I wished to get a series of observations for chronometer rate, so as to determine, if possible, the exact longitude of this place, and by comparing that with the longitude of Bow Fort, obtain the direction of this portion of the chain, as the two places occupy similar positions with reference to it. The latitude of the point where the north branch leaves the mountains is 52° 20' N. The longitude I have not yet ascertained, but by account 117° W.

While resting at this place, the Indian killed several ewes of the big horn, the flesh of which we dried to serve as provision to take us to Edmonton. Here we were met by a band of Assineboines, who came and camped beside us, and from whom I obtained a fresh horse for one that was too much reduced to proceed further. The weather was again very unsettled at this time, and several inches of

snow fell, which continued to lie on the mountains. We started for the Rocky Mountain House on the 27th. and, leaving the north branch to the south, passed through a nick in Brazeau's range. This range is formed of limestone beds tilted up at an angle of 30° to W. They are wooded to their summits on the west side, and rise to about 2,000 feet above the valley.

Having again met the north branch, we followed it down through thick forests, till, on the night of the 31st, we reached the Mountain Fort in lat. 51° 28' N., long. 115° 7' W. The fort is deserted all summer, being only a winter post for the Blackfeet. The traders had not yet arrived, so we found it looking very desolate, with the courtyards choked with weeds, and all the windows and doors were standing open. We took possession of it for the two nights we were at this place, but did not find it so comfortable as our camp fire.

On 2nd October I left the Mountain House for Edmonton, following the road I had travelled between the two places last winter. We were again out of provisions; but as we were now travelling among poplars, we had no difficulty in supporting ourselves on rabbits.

A severe snow storm, which covered the ground to the depth of 18 inches, quite fatigued our horses, so that we had to load our riding horses; and in this manner only with difficulty reached this place on the 7th.

Capt. Palliser, &c. &c.

I remain, &c.

JAMES HECTOR, M.D.

Enclosure 2 in No. 8.

Enclosure 2
in No. 8.

CHARGES against Lieut. BLAKISTON in account British North American Exploring Expedition,
under the Command of Captain PALLISER.

	£	s.	d.
August 12, 1858—To use of ten horses from August 12 to September 28, 1858,			
at 2s. per diem—2s. -	47	0	0
To use of three men from August 12 to September 28, 1858,			
at £3½ per month—£3½	15	0	0
To goods for payment of Indian	2	0	0
	<u>£64</u>	<u>0</u>	<u>0</u>

See Captain Palliser's letter to Her Majesty's Principal Secretary of State for the Colonies, page 33, of October 7, 1858.

Enclosure 3 in No. 8.

Enclosure 3
in No. 8.

Site of Old Bow Fort, Base of Rocky Mountains,
August 11, 1858.

Sir,

After our conversation on the 3rd inst., from which I infer that private matters influence you in your public duties, my position in Her Majesty's service will not allow of my considering myself any longer in any way connected with the Exploring Expedition under your command.

I shall, however, carry out to the best of my power what I had undertaken previously to our conversation above referred to, namely, to survey the Kootanie Pass, and in the event of my reaching Edmonton in sufficient time, proceed with the Red River men by water to Fort Carlton, and arrange for their transport to Red River.

I have, &c.

(Signed) THOMAS BLAKISTON,
Lieutenant, Royal Artillery.

John Palliser, Esq.,
Commanding Exploring Expedition.

No. 9.

COPY of REPORT from Captain PALLISER to HER MAJESTY'S PRINCIPAL SECRETARY
OF STATE FOR THE COLONIES.

Fort-Edmonton, Saskatchewan, January 10, 1859.

(Received April 8, 1859.)

MY LORD,

I AVAIL myself of the opportunity afforded by the Hudson's Bay Company's Winter Express to send a few lines to your Lordship, although I have nothing of any importance to communicate, owing to the advance of the winter season having put a stop for the present to the further progress of the Expedition.

Shortly after our arrival at winter quarters here, Dr. Hector started as soon as the snow was sufficiently deep for sleighing to ascend the Red Deer River, with the object of examining the remainder of a portion of country previously visited last fall. I also started myself in a south-easterly direction to examine the country surrounding Beaver Lake.

I am happy to say that the horses are enduring the severities of the winter very fairly; I have lost but two as yet, and I trust that the rest, with but few exceptions, will outlive the winter. They are at present removed about twenty miles from the fort, for fear of being stolen by the Indians; they are guarded by three of my men stationed there, and constantly visited either by my Secretary, Mr. Sullivan, or by myself. The horses we ride backward and forward for that purpose are being stabled at the fort.

The fort is built altogether of wood, consisting of one good sized house two storeys high, inhabited by Mr. Christie, the officer in charge of this post and the Company's traders, and also by ourselves during our stay here. Adjoining this house are the store-houses of the Company, containing their goods and furs, besides the log houses inhabited by the men engaged by the Company together with their wives and families; the whole is surrounded by wooden pickets or piles, firmly driven into the ground close together, and about 20 feet high.

In shape it is an irregular hexagon, about 100 yards long and 70 wide, and contains a population of about 40 men, 30 women, and 80 children, almost entirely supported on buffalo meat, the hauling of which, for sometimes upwards of 250 miles across the plains, is the source of great and most fruitless expense. Indeed, the labour and the difficulty of providing for a consumption of 700 lbs. of buffalo meat daily, and from so great a distance, would frequently become very precarious, were it not for an abundant supply of fish from Lake St. Anne, about 50 miles to the west of the fort, whence they are capable of hauling 30,000 or 40,000 in a season; these are a fine wholesome white fish, averaging four pounds weight each. Besides this, great quantities of provisions are traded here, it is the principal depôt for provisions, as the several brigades of boats are most supplied from this place. Few fine furs are traded here, those which are obtained being chiefly from half-breeds, belonging to a Settlement recently made at Lake St. Ann's.

There is a Roman Catholic Mission, under the direction of two French priests, who have induced the half-breeds to cultivate the ground, and sometimes they realize very fair crops of barley and potatoes.

A very little agriculture is feebly carried on about Fort Edmonton, owing partly to the want of acquaintance with even the leading principles of agriculture, and principally from the disinclination of both the men and women to work steadily at any agricultural occupation.

I have the honour of enclosing a letter from Dr. Hector on the subject of the geology of that portion of country which was explored last year by the expedition, also the astronomical observations of last year, which I request may be forwarded to the Geographical Society. I shall reserve my observations, and those of my secretary, Mr. Sullivan, on the longitude of Edmonton until the state of the atmosphere will allow (perhaps) of greater accuracy, for it is important that its longitude should be more accurately ascertained than any one has obtained it hitherto.

I also enclose a separate record of observations taken on the comet, which I will feel much obliged by your Lordships forwarding to the Astronomical Society.

F

As I had the honour to communicate my plans and intentions already to your Lordship in my letter of October last, I shall not take up any more of your time.

I have, &c.

(Signed) JOHN PALLISER, Captain,
Commanding N.W. British American
Exploring Expedition.

Her Majesty's Principal Secretary of State
for the Colonies, &c.

P.S. I am unable, as yet, to forward the accounts of the present financial year, as they have not yet arrived from Montreal, where they are sent to be priced by Sir George Simpson.
J. P.

Encl. 1. in
No. 9.

Enclosure 1. in No. 9.

Fort Edmonton, Saskatchewan,
January 10, 1859.

SIR,

I HAVE the honour to make the following report of my geological observations during the past season, in which is embodied only the principal results and general features of the country examined, the details being reserved for a more elaborate study and comparison than can be executed here.

On starting from Fort Carlton on 14th of June, 1858, we crossed the low track of prairie land which is bounded to the west by that line of high ground, which has been traced from longitude 103° W. sweeping to the N.W. to meet the south branch of the Saskatchewan at the elbow, known as the "Coteau des Prairies," and from that point being continued to the north branch as the Bad Hills and Eagle Hills, while across that river it re-appears as the Thickwood and White Lake Hills. The average elevation of these plains above Carlton (which is built upon the first river level, 35 feet above the water) is 250 feet, or 2,125 feet above the level of the sea, and on it rests isolated portions of the higher level which have survived the general denudation, rising as rounded hills from 300 to 400 feet in height, such as Moose Hill on the south branch, and the two Minetonass Hills (Creer Hill by itself), one of which is opposite to Carlton and the other to Forte à la Corne. These plains are plentifully strewn with erratic blocks of all sizes, being fragments of the rocks of the Granitic belt, which runs to N.W. from Lake Superior to the Arctic Sea, with others of Magnesian limestone and buff coloured quartzite rock of Silurian age, which crops out all along the western flank of that range. A very remarkable line of the Magnesian limestone boulders occurs at the distance of 20 miles above Carlton, crossing the country from the Thickwood Hills in a southerly direction towards the Moose Hills on the south branch.

This limestone contains the same indistinct fossiliferous markings as that at the Stoney Hill behind Fort Garry. Some of these masses are of immense size, being made up of portions of several beds which only loosely cohere to form the block. They are all sub-angular, without any glacial markings, although some have their sides highly polished and smoothed from the buffalo rubbing against them. One of these blocks was measured, and computed to be 140 tons.

The nearest known point where this limestone occurs in situ, from whence these block may have been derived, is 170 miles distant to N.E.

Disregarding, for the sake of clearness, the order in which the country was examined, I now give at once, an account of the whole "drift" phenomena observed.

As we travelled to the west the drift was found to preserve the same mineral character of variable proportions of sand and clay, having boulders interspersed, but chiefly with the clay predominating. The boulders, however, decrease in size, and those of limestone become very rare as the higher plains are gained. At Fort Edmonton, for instance, I found it difficult last winter to procure fragments, with which to make lime for medicinal purposes, although the river bed is strewn with those of other rocks. Its depth also becomes much less, forming only a superficial covering to older strata, when observed in the river sections to the west of the Eagle Hills.

As we approached the Rocky Mountains, it quite disappears from the table lands, and is only to be found in depressions of the plain through which streams run, and even the existence of true drift in these places is rendered doubtful, owing to the prevalence of more recent deposits, which have been formed of its re-arranged materials.

At the altitude of 4,000 feet above the sea, and at the distance of 50 miles from the mountains, there however occurs a very extraordinary group of blocks of granite, resting upon a high plateau, formed of sandstone strata, to be afterwards mentioned. These blocks are of great size, one having been estimated to weigh 250 tons. Although lying miles apart, they seem to consist of the same rock, viz. a mixture of quartz with red felspar, the latter predominating, with only faint traces of mica disseminated in very minute flakes. No granitic rocks have been met with on this side of the watershed of the mountains, and it is not probable that any such exist, at least between the two branches of the Saskatchewan.

These blocks present smooth surfaces, although in general they are rhomboidal in form. Some are cracked into several pieces, which are quite detached, but have evidently at one time formed part of a whole.

If these blocks were derived from the granitic belt to the east, as I believe all the other boulders on the plains to have been, then they must have travelled at least from 400 to 450 miles. From the fact however, that they are almost on the western verge of the drift deposit, and that the boulders imbedded were found as a rule to diminish in size in that direction, it may be that the presence of these large blocks is due to very different agencies, different at least in the time of their occurrence.

Close in, along the base of the mountains, neither on the high plateaus or in the profound valleys by which these are traversed, was there observed any traces of the drift, or its dispersed erratics. Within the outer range of the mountains, which are comparatively low and wooded to their summit, the valleys are occupied by immense deposits of rounded shingle, composed of fragments of the various rocks which have been found to compose the mountains. This shingle, which in some places is loose, and mixed with a large proportion of sand and gravel, in others is cemented by calcareous matter into a solid conglomerate. It fills up the valleys not only along the edge of the mountains, but also right into their interior, forming beautifully marked terrace levels along the streams. This is well exhibited on the north branch of the Saskatchewan, where these deposits skirt its wide valley for nearly 70 miles of its course through the mountains, expanding where it widens so as to form extensive plains, as at the Kootanie plain, and always affording a margin of level ground along the river, rendering the road very practicable.

Towards the upper ends of the valleys the calcareous matter of these deposits so increases as to replace altogether the shingle, when it becomes a fine gritty calcareous mud of glistening whiteness. This same deposit has a much larger development in the valleys on the west side of the watershed, forming terrace levels in exactly the same manner. I observed no shingle beds with it there, however, that apparently being replaced by fine sand and gravel.

In the valley of Bow River, there is much less of this calcareous matter in the deposit, it having more of a loose sandy nature, and except at the entrance to the valley in the neighbourhood of the Bow fort, rarely exhibiting the terrace levels.

In the smaller gorges, where streams come down from the mountains, it is replaced by an angular "brecchia," of which patches cling in the most singular positions. This latter deposit is most likely of the nature of glacier maraines, although it is found where no glacier occurs anywhere in the neighbourhood. I found, however, that the glaciers in the chain had, at one time, extended a considerable degree beyond their present limits, and therefore, at that time they possibly may have existed in portions of the mountains where now there are none.

The terrace deposits seem to reach pretty nearly the same altitude in different parts of the mountains viz., about the height of 1,000 feet above the level of the plains at their eastern base.

I found that, in crossing the different heights of land, the easiness of the pass corresponded with the degree to which these deposits had remained untouched, owing to peculiarities in the form of the valleys. In the case of every height of land, whether of those examined by Captain Palliser or by myself, with the single exception of the Vermillion pass, the slope is gradual to the east, but to the west the descent is with extreme rapidity. This arises from these deposits, having being scooped out close up to the rocky nucleus of the height of land, by currents acting from the western side of the chain, while on the east the erosion has been much more feeble.

How much this may depend on the difference between the width of the valleys which pass through the flanking chains on the east side of the height of land from those on the west, I am not prepared to say, until the nature of the country to the west has been ascertained.

Currents acting on the chain while submerged, would of course be greatly modified in their action by any such differences.

Respecting the age of these deposits I am in doubt. They extend towards the east along the river valleys, at least shingle deposits of the same nature are found at a considerable distance from the mountains, in the valleys of the north and south branches, and of the Red Deer River. Its relations to the drift has not been distinctly ascertained, as the boulders which mark its presence are only in that district of country found on rounded knolls away from the rivers.

From observations made last summer on the south branch, and during the winter on the north branch of the Saskatchewan taken with those of this season, I found that the group of sandy clays with crystals of selenite and concretionary nodules of ironstone, which latter contain fragments of cretaceous fossils, extend from the Snake Portage (which is in lat. 54° , and long. $111^{\circ} 30' W.$ nearly) upon the north branch, in a south-south-easterly direction, to the elbow of the south branch, the distance in a straight line between these two places being 240 miles. The north branch, which flows from the Snake Portage to south-east, exhibits in its banks sections of these clays until they disappear under the great depth of drift at the Eagle Hills, thus crossing this formation very obliquely, it forming a strip of not more than 60 miles in breadth; whether this strip be continuous or not cannot be ascertained, as the high plains which lie between the arms of this great river, nowhere are cut to a sufficient depth to reach their level.

It is difficult to observe any dip, but I think they must have a slight inclination to north-east. At the Snake Portage these clays are of a clear blue colour, soft, and having selenite crystals in tolerable abundance. At Fort Pitt and at the elbow of the south branch they have much the same character,

being of a dark purple brown-colour, with the septariae very frequent, and the selanite only so in some parts. At the Eagle Hills they are not so moist, and form rather a compact shale of a bluish buff colour, much stained with ferruginous streaks; it cracks up into very small fragments with conchoidal surfaces, the septariae are neither so abundant. This formation here, if dried and hardened, would much resemble the shales observed at Long River, and at Fork Creek on the Assiniboine during the summer of 1857. A little way above the Snake Portage (which place I again visited this autumn) hills rise above the plain level on both sides of the river to about 300 to 500 feet, such as the Black Hills, Snake Hills, and Egg Lake Hills; these consist of coarse grits formed of pink and green grains, with a small amount of calcareous cement, quite the same as those observed in the neighbourhood of the Mountain House. They are in thin beds which weather into spheroidal masses, and between these beds of blue and purple clay are found. It is the same sandstone as is found throughout the Edmonton and Mountain House coal basins, forming the floor upon which they rest.

These basins are divided from each other by a great thickness of buff-coloured sandstone of much the same texture, but not so distinctly bedded, which forms a high ridge crossing the country from Red Deer River at the Nick Hills, by the Musquachis on Battle River to the north branch at Abraham's Gates. At these places it forms lofty precipices which I think must be similar to those described as the ramparts on the Mackenzie and Peace rivers.

On Red Deer River, in lat. $52^{\circ} 12' N.$, long. $113^{\circ} W.$, an extensive deposit of coal was discovered associated with the same sands and clays as at Edmonton. The coal forms beds of much greater thickness however, one group of three beds measuring 20 feet, of which 12 feet were pure coal, the remainder being carbonaceous clays. At one place this coal was on fire, the whole bed exposed in a cliff about 300 yards in length being in a glow, the constant sliding of the bank continuing to supply a fresh surface to the atmosphere. For as long as the Indians remember this fire had never been extinguished, summer or winter.

A heavy sulphurous and limey smell pervades the air for miles around.

The extent of this coal deposit along Red Deer River is for 14 miles. In following up the river it is succeeded by the sandstone cliffs, apparently by substitution, as neither the coal group nor the beds of sandstone have any perceptible dip, and this is exactly the same manner in which the passage is effected between the same groups at the Mountain House.

Lower down on the river the coal is succeeded by white marls and sands, with beds of calcareous grit, which weather to a bright red colour. Among these beds there occur a great profusion of fragments of silicified exogenous wood. This group, however, was better exhibited on Battle River, where they dip to north-east at a very low angle. The valley of that river above its elbow is about 14 feet deep, and exhibits in its banks phenomena somewhat like those at La Roche Percée. The strata consist of banded clays and orange-coloured splintery limestone, with one bed quite filled with fragments of silicified wood, of an ashy or black colour. Towards the upper part of the section the clays are filled with sandy concretions, in some of which I found a few beautifully preserved fossils, the principal of which was a small avicula, a cardium, and other littoral shells.

There is also a bed of nine inches in thickness, composed entirely of rolled fragments, of a species of ostrea, cemented together by coarse sand. This bed I detected at several points along the valley, and by using it as a test, found that the whole group had a gentle inclination to north-east. At the point where we crossed Battle River a second time, in lat. $52^{\circ} 28' N.$, long. $111^{\circ} 30' W.$, in the bed of the stream, and at the foot of the section described above, the first coal met with in our progress westward was observed. Whether this be the same coal, however, as that on Red Deer River and at Edmonton, or a thin bed, such as was observed at La Roche Percée, and of quite a different age, I was unable to determine. If the former, then it is certainly overlaid by the Ostrea and Avicula beds; and these fossils when compared at home will throw much light on the true age of this coal. (I regret to say, that owing to the bursting of the hoops of the kegs in which they were packed for carriage to Edmonton from the Bow Fort, some of these fossils, as well as others, were lost on the road; but I hope yet to have an opportunity of procuring another set.)

This group of strata, characterized by the light-coloured marls which were found in Battle and Red Deer Rivers, was not observed along the north branch. The distance between the two points where they were found on the former rivers was 50 miles in a line due west.

The superficial strata which compose the prairie country preserve their horizontal character, as the Rocky Mountains are approached, until within 40 miles of the eastern limits of the true chain. At this distance they commence to undulate at first gently, but soon assuming most intricate plications. The section along the Little Red Deer River displays the structure of the near range, which is wholly made up of the plications of the more superficial strata. The grits and clays of the Snake Portage again re-appear in this section, and are seen not only to change from their almost horizontal arrangement, but also to lose their original mineral character, the clays becoming indurated and converted into hard shales with a smooth soapy streak, while the sandstone beds are cleared in their original lines of false bedding, and rendered so very much harder, that in the summer, when I observed isolated sections I was not sure of their identity, and only removed my doubts this winter by an examination of the continuous section afforded by Little Red Deer River.

From under this group the septaria clays arise, also much altered in character, but I obtained fragments of the same fossils that were found at Fort Pitt, and the elbow of the south branch of the Saskatchewan, so that I have no doubt of their identity. They are found on the west side of the outer range in the valley which intervenes between it and the main chain.

The Rocky Mountains, as far as the west side of the watershed, consist of parallel ranges running from N.N.W. to S.S.E. between the north branch and Bow River, but south of that changing to nearly

north and south. These ranges are in groups, divided from one another by trough-like valleys traversing the length of the chain. The two eastern ranges from the Bow Fort to the Sawback range are mainly composed of a blue limestone, sometimes cherty, sometimes compact, and sometimes crystalline, with fossils which belong either to the carboniferous or devonian epoch. As a rule, these strata dip to the west, the same beds are, however, exhibited again and again, being thrown up in plications of great magnitude. Behind the Bow Fort, the mountains rise as huge cliffs made up of the cut-edges of these strata, elevated to the height of 3,000 feet. Borne up on these limestones is a mass of strata composed of micaceous sandstone, with particles of carbon disseminated. This group also appears along Bow River and Deadman's River, after they leave the mountains. Along with these sandstones are intercalated carbonaceous shales, among which are to be found traces of coal and carboniferous plants, of which latter one was a calamite, somewhat like calamites cannae formis of the coal measures at home.

Resting on the flanks of the limestone ranges are patches of the septaria clays and grits which are recognised at a distance by their earthy appearance. Such patches are found throughout the mountains at different points. Thus at the Vermillion River, the beds which, by their decomposition, give rise to enormous quantities of ochre along the courses of the smaller stream, seem to belong to this group. At the angle which this river makes, about fourteen miles from its source, there is a small patch of about one square mile in extent which presents an unmixed soil of ochre of a light reddish yellow colour, without a trace of vegetation on its surface.

To the west of the Sawback range the limestone was not observed, that range being composed of its bed cropping out vertically along the east side of a valley, in which stands Castle Mount composed of horizontal beds of a hard quartose sandstone, passing into a conglomerate, and capped by brown slaty shale. At the Kootanie plain, on the north branch of the Saskatchewan this shale is seen to underlie the limestone.

The mountains which compose the height of land of the Vermillion pass consist of the same rocks as the Castle Mount, but in descending Vermillion River a white slate is met with, which again is succeeded by a deep blue compact limestone, associated with a clay schist, curiously banded with red layers. On the north branch of the Saskatchewan, the mountains at its source are composed of this blue limestone and banded schist.

The very complicated relations of these strata renders it impossible to form any sound view regarding their thickness or relative positions from data collected during one rapid survey, especially when it is remembered that they compose one of the most massive mountain chains in the world, the topography of which had to be learned step by step as the survey was made.

The most singular fact is, that no trace of the eruptive rocks which have caused the great convulsive movements of this portion of the earth's crust should be found in connexion with the dividing line of the mountains, from which the waters are thrown into the Gulf of Mexico, Hudson's Bay, the Arctic and Pacific Oceans. The direction of these waters seems altogether to be determined by the arrangement of the superficial deposit filling up the valleys.

Towards the lower part of the Vermillion River, the schists are fractured by slaty cleavage, but which is not very perfect. More to the south, however, from Mr. Sullivan's notes, I find that the mountains along the east side of the Kootanie river valley are composed of true clay slate, which also forms those at both heights of land crossed by Captain Palliser's party.

John Palliser, Esq.
&c. &c.

I have, &c.
(Signed) JAMES HECTOR, M.D.

Enclosure 2 in No. 9.

OBSERVATIONS for LATITUDE made by Dr. HECTOR when detached from the Expedition.

Date.	Place.	Obs. Mer. Alt. corrected for I.E.	Longitude by Account.	Latitude.
			W.	N.
1857:				
December 14	Four miles E. of Redberry Lake	* Polaris 108 20 0	106 56 0	52 42 0
" 19	English Creek	⊙ 26 13 0	108 56 0	53 16 0
" 19	E. angle of Red Deer Hill	* Polaris 110 53 0	109 3 0	53 28 0
" 20	Fort Pitt	* " 110 4 30	109 18 0	53 35 0
" 20	"	* Jupiter 97 46 0	-	53 34 0
" 22	"	⊙ 26 32 0	-	53 34 0
1858:				
March 29	"	⊙ 79 20 30	-	53 34 0
January 5	Fort Edmonton	⊙ 28 26 0	113 49 0	53 29 0
" 5	"	* Polaris 109 50 0	-	53 30 0
" 8	"	⊙ 28 0 0	-	53 32 0
February 10	"	⊙ 44 2 0	-	53 30 0
" 11	"	⊙ 44 42 0	-	53 30 0
" 20	"	⊙ 50 51 30	-	53 31 0
March 4	"	⊙ 59 51 0	-	53 31 0
" 6	"	⊙ 61 26 30	-	53 30 0
" 7	"	⊙ 62 9 30	-	53 31 0
January 11	Crossing Place, Battle River, on Mountain Ho. Track.	* Jupiter 99 34 0	114 6 0	52 41 0
" 14	Rocky Mountain Fort	* Polaris 107 53 0	115 30 0	52 29 0
July 9	Elbow of Battle River	⊙ 119 37 0	111 5 0	52 19 0
August 12	Rocky Mountains, Bow River, First Lakes	⊙ 107 19 30	115 16 0	51 1 44
" 14	Rocky Mountains, Bow River, The Nick	⊙ 105 59 0	115 30 0	51 2 26
" 15	Rocky Mountains, Bow River, Cascade Mount	⊙ 105 10 0	115 40 0	51 9 18
" 18	Rocky Mountains, Bow River, Castle Mount	⊙ 103 10 0	116 0 0	51 10 42
" 21	Rocky Mountains, Vermillion River, The angle	⊙ 101 20 0	116 26 0	51 6 0
" 22	Rocky Mountains, Vermillion River, Snow Creek, S. from Mount Ball	⊙ 100 49 0	116 19 0	51 2 45
" 24	Rocky Mountains, Kootanie River, N. of Forks	⊙ 99 48 0	116 26 0	50 52 0
" 26	Rocky Mountains, Kootanie River, its source	⊙ 98 11 0	116 40 0	51 0 37
" 28	Rocky Mountains, Bearfort River	⊙ 96 28 30	116 52 0	51 9 30
" 30	Rocky Mountains, Kicking Horse River Falls	⊙ 95 0 0	116 55 0	51 10 0
September 1	Rocky Mountains, Kicking Horse River Falls	⊙ 93 18 0	116 57 0	51 16 30
" 3	Rocky Mountains, Bow River, Noore's Creek	⊙ 91 38 0	116 38 0	51 22 40
" 8	Rocky Mountains, Bow River, Noore's Creek	⊙ 87 44 0	116 43 0	51 28 0
" 9	Rocky Mountains, Bow River, its source	⊙ 86 34 0	117 0 0	51 40 0
" 11	Rocky Mountains, N.B. Saskatchewan, E. end of Glacier Lake	⊙ 86 36 0	117 30 0	51 54 0
" 12	Rocky Mountains, N.B. Saskatchewan, W. end of Glacier Lake	⊙ 83 54 0	117 39 0	51 52 16
" 14	Rocky Mountains, N.B. Saskatchewan, 4 miles above mouth of Little Fork	⊙ 82 16 0	117 22 0	51 56 30
" 18	Rocky Mountains, N.B. Saskatchewan, 4 miles below Wapattuk River	⊙ 78 45 30	116 46 0	52 18 0
" 20	Rocky Mountains, N.B. Saskatchewan, Sheep River	⊙ 76 41 0	116 40 0	52 24 0
" 23	Rocky Mountains, N.B. Saskatchewan, Sheep River	⊙ 74 21 0	-	52 23 30
" 28	Saskatchewan River, N.B. Miry Creek	⊙ 70 14 0	116 10 0	52 30 0
" 29	N. branch Saskatchewan	⊙ 69 35 30	116 0 0	52 26 0
October 1	S.E. of Mountain, in woods	⊙ 67 20 30	115 25 0	52 23 30
" 5	Bad Bearer Dam	⊙ 42 50 30	113 58 0	53 5 0
November 29	Battle River, Bear Hill	⊙ 30 55 0	113 55 0	52 46 26
December 1	Red Deer River, mouth of Blind River	⊙ 31 10 0	114 0 0	52 18 13
" 2	" 10 miles above last	⊙ 31 6 0	114 10 0	52 12 36
" 4	Red Deer River, 5 miles above Medicine River	⊙ 30 55 0	114 20 0	52 1 26
" 6	Red Deer River, 20 miles above last	⊙ 30 47 0	114 40 0	51 50 28
" 9	Little Red Deer River	⊙ 30 52 0	114 45 0	51 29 28
" 10	" source of	⊙ 30 55 0	114 50 0	51 21 40
" 15	Edge of Plain, Stoney Camp	⊙ 30 7 0	114 45 0	51 25 24

EXPLORATION OF BRITISH NORTH AMERICA.

47

Enclosure 3 in No. 9.

OBSERVATIONS on the COMET at the HUDSON BAY COMPANY'S FORT, EDMONTON 1858.

Approximate Mean Time at Place.	Chronometer Time of Observation.	Observed Distances.	Object.	Error of Chronometer on G.M.T.	Remarks.
1858.	P. H. M. S.	° ' "		M. S.	
Sept. 20th, 8 P.M.	20 15 37 30	34 24 0	Arcturus ?	9 59 slow.	
" 24th, 8 P.M.	24 15 19 34	28 43 20	Arcturus ?		
	24 37	74 7 40	Capella.		
	7 4	127 45 2	Moon		Mean of five sights.
	16 4 43	102 7 30	α Aquilæ.		
	8 30	21 16 45	η U. Major.		
	11 4	22 54 40	ζ U. Major.		
	14 51	22 7 20	ϵ U. Major.		
	18 45	56 13 30	Polaris.		
" 28th, 8 P.M.	28 14 50 22	20 6 20	η U. Major.	10 10	
	54 2	24 37 10	ζ U. Major.		
	56 5	24 38 0	ϵ U. Major.		
	15 9 15	20 49 50	Arcturus ?		
	12 47	96 0 20	α Aquilæ.		
	15 44	59 18 30	Polaris.		
Oct. 2d, 8 P.M. -	2 15 25 25	23 59 20	η U. Major.		
	27 41	29 52 30	ζ U. Major.	10 30	
	29 38	31 52 30	ϵ U. Major.		
	34 0	9 40 0	Arcturus ?		
" 5th, 8 P.M. -	5 14 56 43	1 13 50	Arcturus ?	10 20	At present the comet has changed to S. of Arcturus.
	59 46	31 53 0	η U. Major.		
	15 3 45	38 14 55	ζ U. Major.		
	5 40	40 59 20	ϵ U. Major.		
	7 44	72 38 50	Polaris.		
	10 29	104 18 30	Capella.		
" 12th, 8 P.M. -	12 14 38 3	80 23 20	α Aquilæ.	10 0	
	40 6	32 39 30	Arcturus ?		
	42 1	31 44 40	α Cor Borealis.		
	44 1	58 56 50	α Lyrae.		
	47 8	62 34 50	α Aquilæ.		
	48 59	59 55 30	η U. Major.		
	53 22	66 35 50	ζ U. Major.		
	58 22	95 32 20	Polaris.		
	51 10	70 16 50	ϵ U. Major.		
	57 16	134 23 40	Capella.		
	15 1 34	110 6 20	α Pegasi.		

Approximate Mean Time at Place.	Chronometer Time of Observation.	Observed Altitude of the Comet. (Doub.)	Error of Chronometer on G.M.T.
1858.	D. H. M. S.	° ' "	M. S.
Sept. 27th, 8 P.M. -	27 14 43 42	34 59 40	10 8 slow.
	53 1	32 36 30	
	54 54	32 11 35	
	57 17	31 40 25	
	58 21	31 21 30	
	15 0 34	30 50 0	
" 28th, 8 P.M. -	3 3	30 15 10	10 10 slow.
	28 14 37 45	36 22 20	
	40 47	36 33 52	
	42 17	35 11 0	
	43 23	34 54 10	
	44 31	34 36 30	
	46 2	34 13 25	
	48 28	33 34 10	

N.B.—The index error of sextant +5' 58" is to be applied to each sextant reading which is tabulated in this sheet.

The name of the star to which (?) is affixed I am not quite sure of; it is probably Arcturus.

JOHN PALLISER, Captain,
Commanding North-west British America
Exploring Expedition.

Enclosure 4 in No. 9.

RECORD of ASTRONOMICAL OBSERVATIONS during Seasons 1857-58.

LONGITUDES OBTAINED BY OBSERVATION.

Locality.	Latitude by Observation or by Account.	Approximate M. T. P.	Mean of Chrono- meter Times corrected for E. on G.M.T.	Mean of Observation Altitudes, corrected for.	Longitude.
	N.	1857.	D. H. M. S.	° ' "	W.
Fort William, H.B.C.	48 24 5	June 13, 8 A.M.	13 1 43 39	68 44 7	89 24 50
Trembling Portage	48 30 0	" 21, 9 A.M.	21 2 47 35	88 45 41	89 58 48
Dog Portage (w. end)	48 45 0	" 22, 9 A.M.	22 2 31 59	83 39 51	89 53 45
Dog River (r. bank)	48 55 0	" 23, 8 A.M.	23 2 16 59	78 30 39	89 53 48
Savannah Portage	48 53 0	" 25, 8 A.M.	25 2 7 17	74 43 35	90 13 46
Barrier Portage	48 45 0	" 26, 5 P.M.	26 10 34 15	64 2 23	90 50 24
French Portage	48 40 0	" 27, 10 A.M.	27 4 4 33	109 19 37	91 11 32
Camp Portage	48 25 0	" 29, 7 P.M.	29 13 24 48	11 48 20	92 27 28
	48 27 0	" 30, 7 A.M.	30 1 13 58	53 12 49	92 30 4
Fort Frances, H.B.C.	48 36 15	July 1, 6 P.M.	1 11 55 8	40 59 27	93 33 33
Rainy River	48 50 0	" 3, 9 A.M.	3 3 43 36	99 13 31	94 14 19
Portage de Bois	49 26 0	" 4, 9 A.M.	4 2 42 42	75 36 39	94 48 7
Winipeg River	49 55 0	" 5, 8 A.M.	5 3 2 4	84 34 31	94 45 30
Ditto	50 15 0	" 6, 8 A.M.	6 2 55 52	81 31 54	95 17 19
*Winipeg Lake	50 33 48	" *	*	*	96 33 56
Ditto	50 23 0	" 11, 8 A.M.	11 2 35 26	72 21 2	96 30 25
Upper Fort Garry	49 52 6	" 16, 8 A.M.	16 2 47 47	74 49 20	96 52 27
Post on boundary line, near Pembina	48 59 12	" 25, 3 P.M.	25 10 15 1	73 43 58	96 46 13
Prairie	48 52 0	" 28, 3 P.M.	28 10 39 34	65 34 4	97 17 29
St Joseph	See separate paper.				
Prairie	49 10 0	July 31, 4 1/2 P.M.	31 11 5 27	56 51 56	98 10 39
Ditto	49 8 0	Aug. 2, 4 P.M.	2 10 3 51	76 28 2	98 33 45
Ditto	49 8 0	" 3, 5 P.M.	3 11 6 37	56 18 32	98 47 15
Ditto	49 8 0	" 4, 8 A.M.	4 1 43 38	45 42 32	98 48 24
Ditto	49 0 32	" 5, 4 P.M.	4 10 31 20	67 37 43	99 1 25
Turtle Mount, E. Flk.	49 0 0	" 5, 5 P.M.	5 11 46 16	43 6 52	99 16 50
Ditto	49 6 0	" 7, 5 P.M.	7 11 21 48	50 23 27	99 21 43
Fort Ellice, H.B.C.	See separate paper.				
α Saskatchewan elbow of S. branch	See separate paper, pp. 52, 53, 54.				
Qui'Appelle Lakes, 12 miles S. of	50 20 0	Sept. 13, 3 P.M.	13 10 26 33	49 31 28	103 45 45
Saskatchewan, S. branch of	50 52 48	" 27, 3 P.M.	27 11 32 31	25 19 17	107 41 7
Red Deer Lakes, 6 miles N. of	51 20 0	Oct. 3, 9 A.M.	3 3 43 15	20 27 9	107 32 15
Prairie	51 40 0	" 4, 9 A.M.	4 4 44 59	26 43 30	107 37 51
Ditto	52 5 0	" 5, 2 P.M.	5 9 28 40	24 18 40	107 21 0
Ditto	52 12 0	" 6, 2 P.M.	6 9 43 4	22 11 31	106 51 0
1858.					
Eagle Hills	52 18 0	June 21, 7 A.M.	21 2 9 22	26 52 32	107 28 15
Ditto, 3 miles S. of Lizard Lake		" 21, 4 P.M.	21 11 30 33.5	33 23 19	107 28 16
Eagle Hills, at Stoney Lake	52 14 0	" 22, 3 P.M.	22 9 46 39	48 40 29	107 35 4
Prairie	52 14 0	" 23, 9 A.M.	23 3 15 19.4	42 22 11	108 11 33
Ditto	52 16 0	" 24, 7 A.M.	24 2 8 16.4	25 59 17	108 27 27
Ditto	52 21 0	" 25, 7 A.M.	25 2 30 14.6	29 7 5	108 44 25
Wiquatinow, Valley of	52 28 39	" 26, 8 A.M.	26 3 49 47	40 54 2	108 51 39
Ditto ditto	52 28 39	" 27, 8 A.M.	27 3 50 43	41 1 6	108 52 36
Prairie	52 30 0	July 2, 4 P.M.	2 11 20 15	35 53 22	109 2 30
α Ditto	52 34 25	" 4, 8 A.M.	4 3 28 5	36 46 25	109 23 45
Ditto	52 36 0	" 8, 7 A.M.	8 2 32 13.5	27 27 4	110 23 45
Battle River, 1st crossing of	52 35 39	" 7, 9 A.M.	7 4 12 41.7	42 9 5	110 50 7
Ditto 2d crossing of	52 28 23	" 10, 7 A.M.	10 2 55 48.6	30 4 31	111 29 45
α Dried Mount Camp	52 24 29	" 14, 4 P.M.	14 11 47 15.6	32 59 22	112 14 35

* This observation was accidentally cleaned from slate, leaving however the result as tabulated.

+ These three observations marked thus, may be a little too far to the west, as an examination of chronometer rate, on arrival at Carlton, showed it to have changed.

α Indicates lunar distances observed.

N.B. Frequent examinations of chronometer rate, since the date of the last tabulated longitude, showed us that the rate was unsteady. All longitudes that are determined since that, are the results of lunar distances.

The longitude of Carlton is the result of the accompanying distances, observed while we remained there.

LATITUDES BY OBSERVATION.

Locality.	Date.	Observed Mean Altitude, Corrected for Index Error.	Longitude by Observation or by Account.	Latitude.
	1857.	° ' "	° W. "	° N. "
Fort William, H. B. C.	June 13	129 11 16	89 24 50	48 24 5
Dog Lake (S. shore)	" 22	128 51 27	89 45 0	48 46 11
Prairie Portage	" 24	128 27 37	89 45 0	48 56 16
Fort Frances, H. B. C.	July 1	128 28 41	93 33 33	48 36 15
La Pluie River	" 2	128 29 21	93 50 0	48 47 18
Lac de Bois	" 4	126 4 53	94 48 0	49 33 45
Winnipeg River	" 6	124 6 1	95 20 0	50 21 38
Lake Winnipeg	" 10	122 45 51	96 33 56	50 33 46
Upper Fort Garry	" 16	123 19 28	96 52 27	49 52 6
Prairie	" 22	120 56 52	97 0 0	49 28 43
Post on Boundary Line near Pembina	" 25	120 40 22	96 46 13	48 59 12
Prairie	Aug. 1	117 4 14	97 56 0	49 6 53
Ditto	" 2	116 33 54	98 20 0	49 7 47
Ditto	" 4	115 36 50	98 50 0	49 1 40
St. Joseph	—	See separate paper.		
Turtle Mount, E. Falkland	" 5	115 12 27	99 16 50	49 0 32
Ditto	" 7	113 54 47	99 21 43	49 6 2
Prairie	" 12	109 59 37	100 5 0	49 36 3
Ditto	" 14	107 49 17	101 10 0	50 4 20
α Fort Ellice, H. B. C.	" 17	105 15 0	101 48 0	50 24 32
Ditto	" 21	102 37 40	101 48 0	50 24 24
Prairie	Sept. 11	87 28 35	102 10 0	50 23 40
Ditto	" 18	81 58 55	106 0 0	50 26 26
Ditto	" 19	81 9 45	106 50 0	50 27 39
Ditto	" 20	79 50 55	107 10 0	50 44 45
α Saskatchewan, Elbow of S. Branch	" 22	77 42 7	107 37 30	51 1 24
Saskatchewan, S. Branch of	" 27	74 5 7	107 41 7	50 52 48
Red Deer Lakes, six miles N. of	Oct. 3	68 23 47	107 32 0	51 23 45
Prairie	" 4	66 54 27	107 32 0	51 45 16
Ditto	" 5	65 32 27	107 0 0	52 3 7
Ditto	" 7	63 3 27	106 30 0	52 31 40
α *Fort Carlton, H. B. C.	—	See separate paper, pp. 50, 54, 57.		
Jack Fish Lake	" 23	50 56 37	108 10 0	53 2 6
	1858.			
Eagle Hills	June 21	121 48 35	107 28 15	52 17 59
Prairie	" 23	121 53 35	108 11 33	52 14 37
Wiquatinow, Valley of	" 26	121 16 45	108 52 10	52 28 39
α Sand Hills	July 4	120 5 20	109 22 0	52 31 25
Battle River, 1st crossing of	" 8	119 14 30	110 50 7	52 35 39
Ditto 2d do	" 10	118 59 45	111 29 45	52 28 23
α *Dried Meat Camp	" 14	118 0 5	112 18 45	52 24 29
Bull Lake, 3 miles S.E. of	" 18	116 42 55	112 34 0	52 23 24
Dead Man's Creek	" 20	116 6 45	113 3 0	52 19 25
Nick Hills	" 23	115 8 45	113 40 0	52 12 52
Camp	" 24	115 18 0	114 0 0	51 55 43
α *Cache Camp, Edge of the Woods	" 26	114 31 40	114 10 15	51 52 52
Prairie	Aug. 1	112 47 55	113 55 0	51 19 12
α Slaughter Camp	" 2	112 14 5	113 50 0	51 20 47
Bow River, 1st crossing of	" 4	112 3 55	113 50 0	50 54 46
Most N. Tributary of Belly River,				
1st crossing of	" 6	112 34 30	113 45 0	50 6 23
Tributary of Belly River, 1st cross-	" 7	113 9 5	113 53 0	49 32 31
ing of	" 8	113 29 35	113 50 0	49 5 6
Chief's Mountain, 6 miles N. of	" 10	111 22 25	113 58 0	49 33 50
Tributary of Belly River, 2d cross-	" 13	106 56 25	114 20 0	50 52 49
ing	" 15	105 10 20	115 4 30†	51 8 46
*Woods				
α *Old Bow Fort, Site of	" 19	103 5 25	115 12 0	50 54 17
Kananaski's Pass in Rocky Moun-	" 20	102 44 25	115 12 0	50 45 3
tains	" 21	102 20 35	115 21 0	50 37 1
Ditto	" 22	101 38 45	115 21 0	50 37 49
Ditto	" 23	100 55 55	115 27 0	50 38 55
Ditto				
Tributary of Kootanie River	" 24	100 32 15	115 30 0	50 30 14
Forks, Kootanie River	" 26	99 34 50	115 43 0	50 27 21
Kootanie River	" 27	98 48 40	115 40 0	50 19 24
Ditto	" 28	98 24 40	115 42 45	50 10 13
Ditto	" 29	98 0 0	115 33 0	50 1 14
Tobacco Plain, commencement of	" 30	96 54 25	115 33 0	49 42 41

† See pp. 60 and 62.

LATITUDES—continued.

Locality.	Date.	Observed Mean Altitude, Corrected for Index Error.	Longitude by Observation or by Account.	Latitude.
	1858.	° ' "	° ' "	° ' "
α Stray Camp	Sept. 2	95 12 55	115 27 0	49 58 15
British Kootanie Pass, W. end of	" 6	93 49 5	115 22 0	49 11 21
Ditto Height of Land	" 7	92 47 25	114 58 0	49 19 44
British Kootanie Pass, E. end of	" 9	90 52 15	114 30 0	49 32 3
Middle Tributary of Belly River, coming from Crow Lodge	" 10	89 44 25	114 25 0	49 47 0
Most N. Tributary of Belly River, 2d crossing of	" 11	88 0 40	114 21 0	50 12 16
High Wood River, 4 miles N. of	" 12	86 28 30	114 18 0	50 35 29
Bow River, 7 miles S. of	" 13	84 59 0	114 10 0	50 57 16
*Red Deer River	" Observation of Polaris		114 13 0	52 4 45
Battle River, 3d crossing of	" 18	77 42 25	114 0 0	52 39 44
α*Fort Edmonton	" 22	72 52 40	- - -	53 31 43
Ditto	" 24	71 18 41	- - -	53 31 44
Ditto	Red. to Mer.		- - -	53 32 11
Ditto	Red. to Mer.		- - -	53 31 59
Ditto	Mer. Alt. of Moon.		- - -	53 32 13

* Indicates Latitude obtained by other methods.

α " Lunar Distances observed.

N.B.—The Longitude of Edmonton is omitted as a series of Lunar Distances are being taken for that purpose.

FORT CARLTON.—Lat. 52° 52' 30" N.

1857. December 22d, at 5h. 30m. p.m., (M. T. at place nearly), the following distance was taken between Jupiter and Moon's F. L. (Jupiter E. of Moon). Index Error + 5' 0". Error of Chronometer on M. T. at place 6h. 57m. 21s. fast. Approx. Error on G. M. T. 10m. slow. Mean of 5 sights.

	D. H. M. S.	"	° ' "
Mean of Chron. Times	22 12 23 36.1	Mean of dists.	50 46 53
Error on M. T.	6 57 21.0	Index Error	+ 5 0
	<u>22 5 26 12.1</u>		<u>50 51 53</u>

To compute True and Approximate Alt. of * s' and s.

M. ☉'s R.A.	R.A. of Jup.	Cor.	Cor.	Jup. N.P.D.	½ M. Dist.	In Arc.
H. M. S.	H. M. S.	S.	"	° ' "	H. M. S.	
18 3 57.27	2 16 48.48	7.06	16.9	12 25 44	18 6 0.6	1 22 15.5
1 58.28	3.75	1.76	12.5	9	5 26 13.1	60
5.09	2 16 44.73	12.5	84.5	12 25 35	23 32 13.7	82 15 30
18 6 0.64		3.75	202.8	77 34 25	2 16 44.7	20 33 52
			211.25		21 15 29	
			8.6		2 44 30.9	

$$\sin. \theta = \sqrt{\sin. l' \cdot \sin. p \cdot \cos. \frac{H}{2}}$$

$$\sin. \frac{z}{2} = \sqrt{\sin. \left(\frac{l+p}{2} + \theta \right) \cdot \sin. \left(\frac{l+p}{2} - \theta \right)}$$

$$\begin{aligned}
 \frac{H}{2} & \dots 2 \cos. 20^{\circ} 33' 52'' = 19^{\circ} 942810. \\
 p & \dots \sin. 77^{\circ} 34' 25'' = 9^{\circ} 989702 \\
 l' & \dots \sin. 37^{\circ} 7' 30'' = 9^{\circ} 780717. \\
 & \quad \quad \quad 57^{\circ} 20' 55'' \quad 19^{\circ} 713229 \\
 \theta & \dots \sin. 45^{\circ} 27' 22'' \quad 9^{\circ} 856614 \\
 & \quad \quad \quad \sin. 103^{\circ} 18' 17'' = 9^{\circ} 988185. \\
 & \quad \quad \quad \sin. 11^{\circ} 23' 33'' = 9^{\circ} 295630 \\
 & \quad \quad \quad \quad \quad \quad 19^{\circ} 283815 \\
 & \quad \quad \quad \sin. 26^{\circ} 0' 15'' \quad 9^{\circ} 641907 \\
 & \quad \quad \quad \quad \quad \quad 2 \\
 & \quad \quad \quad \quad \quad \quad 52^{\circ} 0' 30'' \\
 s' & \dots + 37^{\circ} 59' 30'' \\
 & \quad \quad \quad \text{Ref.} + 1^{\circ} 13' \\
 s & \dots \quad \quad \quad 38^{\circ} 0' 43''
 \end{aligned}$$

To compute True and Approximate Altitude of \mathcal{D} m' and m .

$\frac{1}{2}$ M. Dist.	In Arc.	\mathcal{D} 's R. A.	Cor.	Cor.	\mathcal{D} 's N. P. D.
H. M. S. 23 8 36.23 0 23 37.51 0 11 48.59	0 11 48.6 60 11 48 36 2 57 9	H. M. S. 23 7 37.55 58.3 23 8 36.23	116.6 29.14 5 58.30	153.15 3 459.45 7.39	6 9 49s. 7 39 6 2 10 96 2 10

By Formulæ (1) and (2).

$$\begin{aligned}
 2 \cos. 25^{\circ} 57' 9'' &= 19^{\circ} 998848 \\
 \sin. 96^{\circ} 2' 10'' &= 9^{\circ} 997586 \\
 \sin. 37^{\circ} 7' 30'' &= 9^{\circ} 780717 \\
 & \quad \quad \quad 66^{\circ} 34' 50'' \quad 19^{\circ} 777151 \\
 \sin. 50^{\circ} 41' 15'' &= 9^{\circ} 888575 \\
 \sin. 117^{\circ} 16' 5'' &= 9^{\circ} 948840 \\
 \sin. 15^{\circ} 53' 35'' &= 9^{\circ} 437501 \\
 & \quad \quad \quad 19^{\circ} 386341 \\
 \sin. 29^{\circ} 33' 43'' &= 9^{\circ} 693170 \\
 & \quad \quad \quad 2 \\
 & \quad \quad \quad 59^{\circ} 7' 26'' \\
 m' & \dots 30^{\circ} 52' 34''
 \end{aligned}$$

\mathcal{D} S. D.	Cor.	Cor.	\mathcal{D} 's H. Px.	Px. Alt. — H. Px. Cos. App. Alt.	
				Px. nearly.	T. Px.
15 34.7 3	+ 6 5	21.9 5	57 2.4 9	3416 = 3.533518 Cos. m' = 9.933671	3416 = 3.533518 Cos. m'' = 9.937238
15 35.0 Aug. 7.7	3.0 3	1095 9	57 3.3 Red. 7.0	2932 = 3.467189	2956 3.470756
15 42.7			56 56.3		49.16

$$\begin{aligned}
 m' &= 30^{\circ} 52' 34'' \\
 \text{Px.} &= 49^{\circ} 16'
 \end{aligned}$$

$$\begin{aligned}
 & 30^{\circ} 3' 18'' \\
 \text{Ref.} & + 1^{\circ} 35'
 \end{aligned}$$

$$30^{\circ} 4' 53''$$

$$\begin{aligned}
 d &= 50^{\circ} 51' 53'' \\
 \mathcal{D}'\text{s S. D.} &= 15^{\circ} 43'
 \end{aligned}$$

$$50^{\circ} 36' 10''$$

Rejecting seconds:—

 $d = 50^{\circ} 36' 0''$ is to be added to $D = T$. Cent. Dist. $s = 38^{\circ} 0' 0''$ Alts. to be used in Computation. $m = 30^{\circ} 4' 0''$

$$\cos. \theta = \sqrt{\sec. m \cdot \sec. s \cdot \cos. x \cdot \cos. (x - d) \cdot \cos. m' \cdot \cos. s'}$$

$$\sin. \frac{D}{2} = \sqrt{\sin. \left(\frac{m' + s'}{2} + \theta \right) \cdot \sin. \left(\frac{m' + s'}{2} - \theta \right)}$$

 $d = 50^{\circ} 36' 0''$ $s = 38^{\circ} 0' 0'' \sec. = 103468$ $m = 30^{\circ} 4' 0'' \sec. = 1062762$ 118 40 059 20 0 cos. = 9.7076068 44 0 cos. = 9.994935 $s' = 37^{\circ} 58' 47'' \cos. = 9.896652$ $m' = 30^{\circ} 51' 41'' \cos. = 9.933696$ 34 25 14 19.69911941 59 24 cos. 9.84955979 24 38 sin. = 9.99254010 34 10 sin. = 9.26346319.25600325 7 38 sin. 9.628001250 15 16+ 1050 15 26N.A. Dist. at 12h. 50 32 12 P.L. = 263816 46 P.L. = 1.0368T.G.M.T. 12 30 47 7670T.M.T. at P. 5 26 13Longitude 7 4 34 W604)424 34 0Longitude 106- 8 30 WELBOW SOUTH BRANCH, SASKATCHEWAN.—Lat. $51^{\circ} 1' 26''$ N.

1857. September 22d at 4h. 15m. p.m. (M.T. at Place nearly) the following Distance was observed between Sun and Moon. Error of Chronometer on M. T. at Place, 7h. 16m. 50s. fast. Index Error + $4' 17''$. Approximate Error on G.M.T. 10m. fast.

Mean of Chronometer Times
Error

H. M. S.
22 11 35 51.7
7 16 50

Mean of Dists. 52 29 4
Index Error + 4 17

T.M.T. at Place

22 4 19 1.7

52 33 21

☉'s N.P.D.	Cor.	Cor.	Eq. of T.	½ App. H. L.	In Arc.	½ (P + p.)
0 14 11.3 N.	58.53	864	M. S.	H. M. S.	H. M. S.	0 14 11.3
11 7.2	11.4	11.4	4 19 1.7	4 19 1.7	2 13 16.52	89 56 56
			7 21 5		60	38 58 34
0 3 4.1	23412	3456	9.85		133 16 31	128 55 30
	64383	9504			33 19 7.8	64 27 45
89 56 56	667.42	9.8496	7 31 35			
	11.7.2					

$$\sin. \theta = \sqrt{\sin. l' \cdot \sin. p \cdot \cos. 2 \frac{H}{2}}$$

$$\sin. \frac{z}{2} = \sqrt{\sin. \left(\frac{l' + p}{2} + \theta \right) \cdot \sin. \left(\frac{l' + p}{2} - \theta \right)}$$

$$\frac{H}{2} \dots 2 \cos. 33 \ 19 \ 8 = 19^{\circ} 844028$$

$$l' \dots \sin. 38 \ 58 \ 34 = 9^{\circ} 798588$$

$$p \dots \sin. 89 \ 56 \ 56 = 9^{\circ} 000000$$

$$\sin. 64 \ 27 \ 45 = 19^{\circ} 642616$$

$$\sin. 41 \ 30 \ 18 = 9^{\circ} 821308$$

$$\sin. 103 \ 58 \ 3 = 9^{\circ} 982913$$

$$\sin. 22 \ 57 \ 27 = 9^{\circ} 591118$$

$$19^{\circ} 574031$$

$$\sin. 37 \ 45 \ 40 = 9^{\circ} 787015$$

$$75 \ 31 \ 20$$

$$s' \dots 14 \ 28 \ 40$$

$$+ 3 \ 29$$

$$s \dots 14 \ 32 \ 9$$

To compute True and Approximate Altitude of D , m' and m .

R. A. of M. \odot .	D's R. A.	Cor.	Cor.	D's N. P. D.	$\frac{1}{2}$ Hr. L.	In Arc.
H. M. S. 12 5 10.65 1 48.42 3.28	H. M. S. 15 15 26.19 40.6 15 16 6.79	121.8 40.6	92.01 2 18402 3.4	22 36 20 s. 3 4 22.39 24 112 39 24	H. M. S. 12 7 2.35 4 19 1.7 16 26 4.05 15 16 6.79 1 9 57.26	0 34 58.63 60 34 58.38 8 44 40

By Formulae (1) and (2).

$$2 \cos. 8 \ 44 \ 40 = 19^{\circ} 989846$$

$$\sin. 112 \ 39 \ 24 = 9^{\circ} 965122$$

$$\sin. 38 \ 58 \ 34 = 9^{\circ} 798588$$

$$75^{\circ} 48 \ 59 = 19^{\circ} 753556$$

$$\sin. 48 \ 50 \ 59 = 9^{\circ} 876778$$

$$\sin. 124 \ 39 \ 58 = 9^{\circ} 915126$$

$$\sin. 26 \ 58 \ 0 = 9^{\circ} 656351$$

$$19^{\circ} 571677$$

$$\sin. 37 \ 38 \ 28 = 9^{\circ} 785838$$

$$2$$

$$75 \ 16 \ 56$$

$$14 \ 43 \ 4$$

D's S.D.	Cor.	Cor.	D's H. Px.	Px. in A. = H. Px. in Cos. App. Alt.	
				Px. nearly.	
14 47.5 6	— " .7 11.4	— 2.7 11.4	54 9.6 2.5	3240 = 3.510545 cos. m' = 9.985514	3240 = 3.510545 cos. = 9.987186
14 46.9 Aug. 3.6	798 6	108 297	54 7.1 Red. 6.7	3134 3.496059	3146 3.497731
14 50.5		3078 2.5	54 0.4		

$$\begin{array}{r}
 m' = 14 \ 43 \ 4 \\
 \text{Px.} - \quad 52 \ 26 \\
 \hline
 13 \ 50 \ 38 \\
 \text{Ref.} + \quad 3 \ 38 \\
 \hline
 m = 13 \ 54 \ 16
 \end{array}$$

$$\begin{array}{r}
 d = 52 \ 33 \ 21 \\
 \text{y's S. D.} + 14 \ 50 \\
 \text{O's S. D.} + 15 \ 59 \\
 \hline
 53 \ 4 \ 10
 \end{array}$$

Rejecting seconds :—

$$\begin{array}{l}
 d = 53 \ 4 \ 0 \quad \therefore 10 \text{ is to be added to } d = \text{T. Cent. Dist.} \\
 s = 14 \ 32 \ 0 \\
 m = 13 \ 54 \ 0 \quad \left. \begin{array}{l} \\ \end{array} \right\} \text{Alts. used in Computation.}
 \end{array}$$

$$3. \dots \dots \sqrt{\sec. m \cdot \sec. s \cdot \cos. x \cdot \cos. (x - d) \cdot \cos. m' \cdot \cos. s'} = \cos. \theta$$

$x \text{ being } \frac{1}{2}(m + s + d).$

$$4. \dots \dots \sqrt{\sin. \left(\frac{m' + s'}{2} + \theta \right) \cdot \sin. \left(\frac{m + s'}{2} - \theta \right)} = \sin. \frac{D}{2}$$

$$\begin{array}{r}
 d = 53 \ 4 \ 0 \\
 s = 14 \ 32 \ 0 \text{ sec.} = .014124 \\
 m = 13 \ 54 \ 0 \text{ sec.} = .012908 \\
 81 \ 30 \ 0 \\
 40 \ 45 \ 0 \cos. = 9.879420 \\
 12 \ 19 \ 0 \cos. = 9.989887 \\
 14 \ 28 \ 31 \cos. = 9.985991 \\
 14 \ 42 \ 48 \cos. = 9.985525
 \end{array}$$

$$14 \ 35 \ 39 \quad 19.867855$$

$$30 \ 45 \ 36 \cos. \quad 9.933927$$

$$45 \ 24 \ 15 \sin. = 9.852527$$

$$16 \ 12 \ 57 \sin. = 9.446002$$

$$19.298529$$

$$26 \ 28 \ 57 \sin. \quad 9.649264$$

$$2$$

$$52 \ 57 \ 54$$

$$+ \quad 10$$

$$52 \ 58 \ 4$$

$$\text{N. A. Dist. 12 H.} \dots 53.11 \ 50 \text{ P. L.} \quad 3450$$

$$13 \ 46 \text{ P. L.} \quad 1.1164$$

$$30 \ 28$$

$$7714$$

$$\text{T. G. M. T.} \dots 11 \ 29 \ 32$$

$$\text{T. M. T. at P.} \dots 4 \ 19 \ 2$$

$$\text{Longitude} \dots 7 \ 10 \ 30 \text{ W.}$$

$$60$$

$$4)430 \ 30 \ 0$$

$$\text{Longitude} \dots 107 \ 37 \ 30 \text{ W.}$$

FORT CARLTON.—Lat. $52^{\circ} 52' 30''$ N.

1858. May 19th, at 11. 10m. p.m. (M. T. at Place nearly) the following Lunar was taken (Sun-W. of Moon).
 —Index-Error +3' 30". Error of Chronometer on M.T. at Place, 6h. 40m. 5s. fast, and Approximate
 Error, on M. T., 12m. slow.

(Mean of 10 sights.)

$$\begin{array}{r}
 \text{Mean of Chronometer Time} - \quad - \quad \text{D. H. M. S.} \\
 \text{Error} - \quad - \quad 19 \ 7 \ 48 \ 33.9 \\
 \quad \quad \quad - \quad - \quad 6 \ 40 \ 5.0 \\
 \hline
 \text{T. M. T. at P.} - \quad - \quad 19 \ 1 \ 8 \ 28.9
 \end{array}$$

$$\begin{array}{r}
 \text{Mean of Dists.} - \quad - \quad 89 \ 3 \ 32 \\
 \text{Index Error} - \quad + \quad 3 \ 30 \\
 \hline
 89 \ 7 \ 2
 \end{array}$$

To compute True and Approximate Altitude of \odot , s' and s :—

\odot 's N. P. D.	Cor.	• Cor.	Eq. of T.	\odot 's $\frac{1}{2}$ App. Hr. L.	In Arc.	$\frac{1}{2}$ sum ($l+p$).
° ' "	"	s.	M. S.	H. M. S.	H. M. S.	° ' "
19 46 9.9N	31.77	.118	3 48.67	1 8 28.9	0 36 8.3	70 9 36
4 14.2	8	8	.99	3 47.7	60	37 7 30
19 50 24.1	254.16	.994	3 47.73	1 12 16.6	36 8 18	107 17 6
70 9 35.9	4 14.2			0 36 8.3	9 2 4	53 38 33

$$\sin. \theta = \sqrt{\sin. l' \cdot \sin. p \cdot \cos. 2 \frac{H}{2}}$$

$$\sin. \frac{z}{2} = \sqrt{\sin. \left(\frac{l+p}{2} + \theta \right) \cdot \sin. \left(\frac{l+p}{2} - \theta \right)}$$

$$\frac{H}{2} \dots \dots \dots 2 \cos. 9 \ 2 \ 4 = 19.989160$$

$$p \dots \dots \dots \sin. 70 \ 9 \ 36 = 9.973425$$

$$l' \dots \dots \dots \sin. 37 \ 7 \ 30 = 9.780717$$

$$53 \ 38 \ 33 \quad 19.743302$$

$$\sin. 48 \ 5 \ 5 \quad 9.871651$$

$$\sin. 101 \ 43 \ 38 = 9.990839$$

$$\sin. 5 \ 33 \ 28 = 8.986096$$

$$18.976935$$

$$\sin. 17 \ 56 \ 6 \quad 9.488467$$

$$35 \ 52 \ 12$$

$$s' \dots \dots \dots 54 \ 7 \ 48$$

$$R \text{ and } Px. \quad + \quad 36$$

$$s \dots \dots \dots 54 \ 8 \ 24$$

To compute True and Approximate Altitude of \mathcal{D} , m' and m :—

M. \odot 's R. A.	\mathcal{D} 's R. A.	Cor.	Cor.	\mathcal{D} 's N. P. D.	$\frac{1}{2}$ M. Dist.	In Arc.	$\frac{1}{2}$ ($l+p$).
H. M. S.	H. M. S.	"	"	° ' "	° ' "	° ' "	° ' "
3.47 27.53	10 0 5.06	125.95	143	13 51 36.9	3 48 48.35		76 10 46
1 18.85	25.08	2.9		2 23	1 8 28.9	2 31 36.4	37 7 30
1.97	10 0 30.01	12	2.23	13 49 13.9	4 57 17.2	60	113 18 16
3 48 48.35		25.08		76 10 46	10 0 30.1	151 36 26	56 39 8
					5 3 12.9	37 54 6	

By Formulæ (1) and (2) :—

$$\frac{H}{2} \dots \dots \dots 2 \cos. 37 \ 54 \ 6 = 19.794228$$

$$l' \dots \dots \dots \sin. 37 \ 7 \ 30 = 9.780717$$

$$p \dots \dots \dots \sin. 76 \ 10 \ 46 = 9.987240$$

$$56 \ 39 \ 8 \quad 19.562185$$

$$\sin. 37 \ 9 \ 41 \quad 9.781092$$

$$\sin. 93 \ 48 \ 49 = 9.999037$$

$$\sin. 19 \ 29 \ 27 = 9.523298$$

$$19.522335$$

$$\sin. 35 \ 14 \ 20 \quad 9.791167$$

$$70 \ 28 \ 40$$

$$m' \dots \dots \dots 19 \ 31 \ 20$$

D's S. D.	Cor.	Cor.	D's H. Px.	Px. in A. = H. Px. Cos. App. Alt.	
				Px. nearly.	T. Px.
15 53.7 4.5	-6.6 8.2	-24.2 2.0	58 12.1 16.4	3469 = 3.540204 cos. m' = 9.974302	3469 = 3.540204 cos. m'' = 9.976702
15 49.2 Aug. 5.0	132 528	8.2 16.4	57.55.7 7.0	3.514506	3288 3.516906
15 54.2	54.12 4.5		57 48.7		

m' = 19 31 20
Ref. + 2 40

19 34 0
Px. - 54 48

18 39 12

89 7 2
O's S. D. + 15 50
D's S. D. + 15 54

89 38 46

Rejecting seconds :-

d = 89 39 0 ∴ 14'' is to be subtracted from D = T. Cent. Dist.
s = 54 8 0 } Alts. used in Computation.
m = 18 39 0

$$3. \dots \cos. \theta = \sqrt{\sec. s. \sec. m. \cos. x. \cos. (x - d). \cos. m'. \cos. s'}$$

x being $\frac{1}{2}(s + m + d)$

$$\sin. \frac{D}{2} = \sqrt{\sin. \left(\frac{m' + s'}{2} + \theta \right) \cdot \sin. \left(\frac{m' + s'}{2} - \theta \right)}$$

d = 89 39 0

s = 54 8 0

m = 18 39 0

sec. = .232176

sec. = .023426

162 26 0

81 13 0

8 26 0

54 7 24

19 31 8

cos. = 9.183834

cos. = 9.995278

cos. = 9.767930

cos. = 9.974296

36 49 16

19.176940

67 11 24

cos. 9.588470

104 0 40

sin. = 9.986884

30 22 8

sin. = 9.703777

19.690661

44 27 25

sin. 9.845330

2

88 54 50

- 14

88 54 36

N. A. Dist. 9H. 89 18 32

23 56

P. L. 2845

P. L. 8763

46 4

5918

T. G. M. T. 8 13 56

T. M. T. at P. 1 8 59

Longitude 7 5 27 W.

60

4)425 27 0

Longitude 106 21 45 W.

FORT CARLTON.—Lat. 52° 52' 30" N.

1858. May 20th at 2H. 30M. P.M. (M. T. at Place nearly), the following Lunar was taken (Sun W. of Moon)
 Index Error +1' 55". Error of Chron. on M. T. at Place 6H. 39M. 37.3s. Approx. Error on
 G.M.T. 12M. slow.

(Mean of 9 Sight.)

Mean of Chronometer Times	-	D. H. M. S.	Mean of Distances	102	5	43
Error	-	20 9 11 49.6	Index Error	-	+	1 55
		- 6 39 37.3				
T.M.T. at Place	-	20 2 32 12.3		102	7	38

☉'s N. P. D.	Cor.	Cor.	Eq. of T.	½ App. Hr. L.	In Arc.	½ (l' + p).
° ' "	"	S.	M. S.	H. M. S.	H. M. S.	° ' "
19 58 52	30.9	14.0	3 45.84	2 32 12.3	1 17 58.4	69 56 11
4 56.7	9.6	9.6	1.34	3 44.5	60	37 7 30
20 3 49						
69 56 11	1854	840	3 44.5	2 35 56.8	77 58 24.	107 3 41
	2781	1260	+ to M.T.	1 17 58.4	19 29 36	53 31 50
	296.64	1.344				
	4 56.7					

$$\sin. \theta = \sqrt{\sin. l' \cdot \sin. p \cdot \cos. \frac{H}{2}} \dots \dots \dots (1)$$

$$\sin. \frac{z}{2} = \sqrt{\sin. \left(\frac{l' + p}{2} + \theta \right) \cdot \sin. \left(\frac{l' + p}{2} - \theta \right)} \dots \dots (2)$$

$$\frac{H}{2} \dots \dots 2 \cos. 19 29 36 = 19.948730$$

$$p \dots \dots \sin. 69 56 11 = 9.972810$$

$$l' \dots \dots \sin. 37 7 30 = 9.780717$$

$$53 31 50. \quad 19.702257$$

$$\sin. 45 13 0 \quad 9.851128$$

$$\sin. 98 44 50 = 9.994919$$

$$\sin. 8 18 50 = 9.160156$$

$$19.155075$$

$$\sin. 22 12 40 \quad 9.577537$$

$$2 \quad 19.155075$$

$$s' \dots \dots 44 25 20$$

$$45 34 40$$

$$R. \& P + 50$$

$$s \dots \dots 45 35 30$$

To compute True and Apparent Altitude of δ , m' , and m .

M. ☉'s R. A.	☉'s R. A.	Cor.	Cor.	☉'s N. P. D.	½ Hr. L.
H. M. S.	H. M. S.	S.	15.1	° ' "	H. M. S.
3 51 24.09	10 50 46.9	117.65	36	7 42 28.3	3 52 58.7
1 28.70	1 10.5	1.96		9 3.6	2 32 12.3
5.91			906		
3 52 58.7	10 51 57.5	36	453	7 33 24.7	6 25 11
		117.6	543.6	82 26 35	10 51 47
		558			4 26 46
		70.56	9 3.6		2 13 23
		1 10.5			

By Formulæ (1) and (2).

$$\begin{array}{rcl}
 \frac{H}{2} & \dots & 2 \cos. 33 \ 20 \ 48 = 19.846748 \\
 l' & \dots & \sin. 82 \ 26 \ 35 = 9.996211 \\
 p & \dots & \sin. 37 \ 07 \ 30 = 9.780717 \\
 & & \hline
 & & 59 \ 47 \ 2 \quad 19.620676 \\
 & & \hline
 & & \sin. 40 \ 15 \ 9 \quad 9.810338 \\
 & & \hline
 & & \sin. 100 \ 2 \ 11 = 9.993303 \\
 & & \sin. 19 \ 31 \ 53 = 9.524166 \\
 & & \hline
 & & 19.517469 \\
 & & \hline
 & & \sin. 35 \ 0 \ 47 = 9.758734 \\
 & & \hline
 & & 70 \ 1 \ 34 \\
 m' & \dots & 19 \ 58 \ 26
 \end{array}$$

p's S. D.	Cor.	Cor.	p's H. Px.	Px. in A. = H. Px. Cos. App. Alt.	
				Px. nearly.	T. Px.
15 40.7 5	- 6.2 9.6	- 22.6 9.6	57.24.4 18.0	3419 = 3.533899 Cos. m' = 9.973078	3419 = 3.533899 Cos. m'' = 9.975452
15 35.7 Aug. 5.5	372 558	1356 2034	57 6.4 7.0	3.506977	3231 3.509351
15 41.2	59.52 5	216.9 18.0	56 59.4		53.51

$$\begin{array}{rcl}
 m' & = & 19 \ 58 \ 26 \\
 R. \ \& \ P. & - & 51 \ 16 \\
 \hline
 m & = & 19 \ 7 \ 10
 \end{array}$$

$$\begin{array}{rcl}
 d & = & 102 \ 7 \ 38 \\
 + & 15 \ 41 \\
 + & 15 \ 50 \\
 \hline
 & = & 102 \ 39 \ 9
 \end{array}$$

Rejecting Seconds :

$$\begin{array}{rcl}
 d & = & 102 \ 39 \ 0 \\
 s & = & 19 \ 7 \ 0 \\
 m & = & 45 \ 36 \ 0
 \end{array}
 \left. \begin{array}{l} \therefore 9'' \text{ is to be added to } D = \text{T. Cent. Dist.} \\ \text{Altitudes used in Computation.} \end{array} \right\}$$

$$\cos. \theta = \sqrt{\sec. s \cdot \sec. m \cdot \cos. x \cdot \cos. (x - d) \cdot \cos. m' \cdot \cos. s'}$$

$$\sin. \frac{D}{2} = \sqrt{\sin. \left(\frac{m' + s'}{2} + \theta \right) \cdot \sin. \left(\frac{m' + s'}{2} - \theta \right)}$$

$d =$	102	39	0	
$s =$	19	7	0	sec. = .024635
$m =$	45	36	0	sec. = .155111
	167	22	0	
	83	41	0	cos. = 9.041485
	18	58	0	cos. = 9.975757
	19	58	16	cos. = 9.973066
	45	35	30	cos. = 9.844954
	32	46	48	19.015008
	71	13	55	cos. 9.507504
	104	0	43	sin. = 9.986881
	38	27	5	sin. = 9.793686
				19.780567
	50	57	52	sin. 9.890283
			2	
	101	55	44	
			+	9
	101	55	53	
N. A. Dist. at 9h.	101	37	2	P. L. 2970
	18	51		P. L. 9800
				6830
T. G. M. T.	9	37	21	
T. M. T. at P.	2	32	12	
Longitude	7	5	9 W.	
			60	
	4	425	9	0
Longitude	106	17	15 W.	

The following are the results of other Lunars taken at Fort Carlton:—

1857.	Dec. 27th	Jupiter and Moon	106 10 15 W.
"	" 28th	" "	106 13 45
1858.	Jan. 18th	Aldebaran and Moon	Not worked.
"	" 21st	Sun and Moon	106 19 15
"	Apr. 20th	" "	106 14 0
"	" 23rd	" "	106 18 37
"	May 22nd	" "	106 17 30
"	" 18th	" "	106 15 0
Mean of Longitudes			106 15 28 W.

N.B.—These Lunars worked at full length, are the greatest and least observed.

They are	106 8 30 W.
	106 21 45
	106 17 15
	47 30
Mean	106 15.50

	106 15 28 W.
	106 15 50 W.
	78
Longitude	106 15 39 W.

PAPERS RELATIVE TO THE

OLD BOW FORT, SITE OF THE.—Lat. $51^{\circ} 9' 0''$ N.
BASE OF ROCKY MOUNTAINS.

1858. August 15th at 3H. 40M. P.M. (M. T. at Place nearly) the following Lunar was observed:—(Sun and Moon) Index Error + $5' 25''$. Error of Chronometer on M. T. at Place, 7H. 29M. 30S. fast.
Approximate Error on G. M. T. 15M. slow.
(Mean of 9 sights.)

Mean of Chronometer Times	D. H. M. S.	Mean of Distances	° ' "
Error	15 11 6 13.4	Index Error	84 4 51
	— 7 29 30		+ 5 25
	15 3 36 43		84 10 16

To compute True and App. Altitude of ☉
 s' and s .

☉'s N. P. D.	Cor.	Cor.	Eq. of T.	$\frac{1}{2}$ M. Dist.	In Arc.	$\frac{1}{2} (l' + p)$.	l'
° ' "	"	S.	M. S.	H. M. S.	H. M. S.	° ' "	
14 5 13.4 N.	47.13	49	4 17.01	3 36 43.4	1 46 15.9	76 3 39.	90 0 0
8 52.5	11.3	11.3	5.33	4 11.5	60	38 51 0.	51 9 0
13 56 20.9	14139	147	4 11.48	3 32 32	106 15.54	114 54 39.	38 51 0
	51843	539					
76 3 39				1 46 15.9	26 33.58	57 27 19.	
	532559	5.537	— to M.T.				
	— 8 52.5						

$$\sin. \theta = \sqrt{\sin. l'. \sin. p. \cos. \frac{2 H}{2}}$$

$$\sin. \frac{z}{2} = \sqrt{\sin. \left(\frac{l' + p}{2} + \theta \right) \sin. \left(\frac{l' + p}{2} - \theta \right)}$$

$$\frac{H}{2} = 2 \cos. 26 33.58 = 19.968084$$

$$p \dots \dots \sin. 76 3 39 = 9.987018$$

$$l' \dots \dots \sin. 38 51 0 = 9.797464$$

$$57 27 19 \quad 19.687566$$

$$\theta \dots \dots \sin. 44 15 26 \quad 9.843783$$

$$\sin. 101 42 45 = 9.968041$$

$$\sin. 13 11 53 = 9.358539$$

$$19.326580$$

$$\sin. 27 25 25 \quad 9.663290$$

$$2$$

$$54 50 50$$

$$s' \dots \dots 35 9 10$$

$$R. \text{ and } P. \dots + 1 14$$

$$s \dots \dots 35 10 24$$

To compute True and App. Altitude of ☽
 m' and m .

R. A. of M. ☉	R. A. of ☽	Cor.	Cor.	☽'s N. P. D.	$\frac{1}{2}$ M. Dist.	In Arc.	$\frac{1}{2} (l' + p)$.
H. M. S.	H. M. S.			S.	H. M. S.	H. M. S.	° ' "
9 34 24.62	14 51 23.75	124.1	98.7	21 32 58.6	9 36 16.3	0 49 32.6	111 36 16
1 48.42	41.2	2.06	2	3 17.4	3 36 43.4	49 32 36	38 51 0
3.28							
9 36 16.32	14 52 4.95	20	197.4	21 36 16	13 12 59.7	12 23 9	150 27 16
		41.2	3 17.4	111 36 16	14 52 4 9		75 13 38
					1 39 5.2		
					0 49 32.6		

By Formulae (1) and (2).

$$\begin{array}{rcl}
 \frac{H}{2} & \dots\dots 2 \cos. & 12 \ 23 \ 9 = 19.979546 \\
 p & \dots\dots \sin. & 111 \ 36 \ 16 = 9.968366 \\
 p' & \dots\dots \sin. & 38 \ 51 \ 0 = 9.797464 \\
 & & 75 \ 13 \ 38 \quad 19.745376 \\
 & \sin. & 48 \ 14 \ 15 \quad 9.872688 \\
 & \sin. & 123 \ 27 \ 53 \quad 9.921284 \\
 & \sin. & 26 \ 59 \ 23 \quad 9.656894 \\
 & & 19.578178 \\
 & \sin. & 37 \ 58 \ 28 \quad 9.789089 \\
 & & 2 \\
 & & 75 \ 56 \ 56 \\
 m' & \dots\dots & 14 \ 3 \ 4
 \end{array}$$

p's S. D.	Cor.	Cor.	p's H. Px.	Px. in A. = H. Px. Cos. App. Alt.	
				Px. nearly.	T. Px.
15 6.7	- 4.8	- 17.4	55 19.7	3296 = 3.517987	3296 = 3.517987
4.5	4	1.5	16.9	Cos. m' = 9.986809	Cor. m'' = 9.988430
15 2.2	11.3	11.3	55 2.8	3197 3.504796	3210 = 3.506417
Aug. 3.7	4.52	4.5	Red. 6.7	53.17	53.30
15 5.9		165	54 56.1		
		16.95			

$$\begin{array}{rcl}
 R. \text{ and } P. & 14 \ 3 \ 4 \\
 & - 49 \ 45 \\
 m & \dots\dots 13 \ 13 \ 19 \\
 & \underline{\hspace{1cm}} \\
 & \underline{\hspace{1cm}}
 \end{array}
 \qquad
 \begin{array}{rcl}
 d & = & 84 \ 10 \ 16 \\
 \odot's \ S. D. & + & 15 \ 50 \\
 \text{D's } S. D. & + & 15 \ 6 \\
 & & \underline{\hspace{1cm}} \\
 & & 84 \ 41 \ 12
 \end{array}$$

Rejecting seconds :—

$$\begin{array}{l}
 d = 84 \ 41 \ 0 \quad \therefore 12'' \text{ is to be added to } D = T. \text{ Cent. Dist.} \\
 s = 35 \ 10 \ 0 \\
 m = 13 \ 13 \ 0 \quad \left. \begin{array}{l} \\ \end{array} \right\} \text{ Alts. used in Computation.}
 \end{array}$$

$$\cos. \theta = \sqrt{\sec. m \cdot \sec. s \cdot \cos. x \cdot (x - d) \cdot \cos. m' \cdot \cos. s'}$$

x being $\frac{1}{2}(m + s + d)$

$$\sin. \frac{D}{2} = \sqrt{\sin. \left(\frac{m' + s'}{2} + \theta \right) \cdot \sin. \left(\frac{m' + s'}{2} - \theta \right)}$$

$$\begin{array}{rcl}
 d & = & 84 \ 41 \ 0 \\
 s & = & 35 \ 10 \ 0 \\
 m & = & 13 \ 13 \ 0 \\
 & & \underline{\hspace{1cm}} \\
 & & 133 \ 4 \ 0 \\
 & & \underline{\hspace{1cm}} \\
 & & 66 \ 32 \ 0 \quad \cos. = 9.600118 \\
 & & 18 \ 9 \ 0 \quad \cos. = 9.977835 \\
 & & 35 \ 8 \ 46 \quad \cos. = 9.912587 \\
 & & 14 \ 2 \ 45 \quad \cos. = 9.986818 \\
 & & \underline{\hspace{1cm}} \\
 & & 24 \ 35 \ 45 \quad 19.576539 \\
 & & \underline{\hspace{1cm}} \\
 & & 52 \ 6 \ 39' \quad \cos. \quad 9.788269
 \end{array}$$

PAPERS RELATIVE TO THE

	76 42 24	sin. = 9° 988205
	27 30 54	sin. = 9° 664624
		<u>19° 652829</u>
	42 6 27	sin. <u>9° 826414</u>
	2	
	84 12 54	
	+ 12	
	84 13 6	
N. A. Dist. 12H.	84 33 4	P. L. 3306
	19 58	P. L. 9550
	42 45	<u>6944</u>
T. G. M. T.	11 17 15	
T. M. T. P.	3 36 43	
Longitude	7 40 32 W.	
	60	
	4) 460 32 0	
Longitude	115 8 0 W.	

OLD BOW FORT, SITE OF THE.—Lat. 51° 9' 0" N.
BASE OF ROCKY MOUNTAINS.

1858. August 16th, at 4H. 39M. P.M. (M. T. at Place) nearly, the following Distances were observed (Sun and Moon), Index Error + 5' 25"; Error of Chronometer on M. T. at Place, 7H. 29M. 21s. fast; Approximate Error on G. M. T. 10M. slow.

(Mean of 9 sights).

Mean Chronometer Times	D. H. M. S.	Mean of Distances	° ' "
Error	16 12 8 33.0	I. Error	95 33 31
	7 29 21.0		+ 5 25
T. M. T. at Place	16 4 39.12		<u>95 58 56</u>

To compute True and Apparent Altitude of ☉
s' and s.

☉'s N. P. D.	Cor.	Cor.	Eq. of T.	½ M. Dist.	In Arc.	½ (l' + p).
N.	"	S.	M. S.	H. M. S.	H. M. S.	° ' "
13 46 22.2	47.67	513	4 5.25	4 39 11.7	2 17 36.4	76 23 24
9 46.3	12.3	13.3	6.3	3 58.9	60	38 51 0
13 36 35.9	14.301	1539	3 58.93	4 35 12.8	137 36 24	115 14 24
76 23 24.1	572.04	6156	— M. T.	2 17 36.4	34 24 6	57 37 12
	586.34	6.309				
	9.46					

$\frac{H}{2}$	2 cos. 34 24 6 = 19°833012
p	sin. 76 23 24 = 9°987630
p'	sin. 38 51 0 = 9°797464
	57 37 12 19°618106
	sin. 40 6 34 9°809053
	sin. 97 43 46 9°996036
	sin. 17 30 38 9°478395
	19°474431
	33 5 41.5 9°737215
	2
	66 11 23
	23 48 37
	Ref. and Par. + 2 1
	23 50 38

To compute True and Apparent Altitude of p
 m' and m .

M ☉'s R. A.	p's R. A.	Cor.	Cor.	p's N. P. D.	$\frac{1}{2}$ M. Dist.		
H. M. S.	H. M. S.	"	S.	° ' "	H. M. S.		
9 38 21.18	15 44 1.01	128.7	7°07	25 6 59.5	9 40 22.9		
1 58.28	44.1	2.1	2.1	2 28.4	4 39 11.7	0 42 35.2	115 9 28
3.44	15 44 45	21	707	25 9 28	14 19 34.6	60	38 51 0
9 40 22.9		21	1414	115 9 28	15 44 45.1	42 35 12	154 0 28
		42	148.4		1 25 10.5	10 38 48	77 0 14
		44.1	2.28		0 42 35.2		

$\frac{H}{2}$	2 cos. 10 38 48 = 19°984918
p	sin. 115 9 28 = 9°956716
p'	sin. 38 51 0 = 9°797464
	19°739098
	sin. 47 46 38 9°869549
	77 0 14
	sin. 124 46 52 9°914523
	sin. 29 13 36 9°688656
	19°603179
	sin. 39 17 30 9°801589
	2
	78 35 0
m'	11 25 0

p's S. D.	Cor.	Cor.	p's H. Px.	Px. in A. = H. Px. Cos. App. Alt.	
				Px. nearly.	T. Px.
14 54.3	-2.7	-10.1	54 34.6	3267 = 3°514149	3267 = 3°514149
1			4	Cos. m' = 9°991321	Cos. m'' = 9°992619
14 54.2	.2	.9	54 34.2	3°505470	3211 3°506768
Aug. 2.9	.4	.4	Red. 6.7		53°31
14 57.1	.08	.36	54 27.5		

PAPERS RELATIVE TO THE

$$\begin{array}{r}
 m' = 11 \ 25 \ 0 \\
 Px. \quad - \quad 53 \ 31 \\
 \hline
 10 \ 31 \ 29 \\
 Ref. \quad + \quad 4 \ 37 \\
 \hline
 10 \ 36 \ 6
 \end{array}$$

$$\begin{array}{r}
 d = 95 \ 38 \ 56 \\
 \odot's \ S. D. \quad + \ 15 \ 50 \\
 \text{M}'s \ S. D. \quad + \ 14 \ 57 \\
 \hline
 96 \ 9 \ 43
 \end{array}$$

Rejecting seconds—

 $d = 96 \ 19 \ 0$ $\therefore 17''$ is to be subtracted from $D = T.$ Cent. Dist.

 $s = 23 \ 50 \ 0$ } Alts. used in Computation.

 $m = 10 \ 36 \ 0$

$$\cos. \theta = \sqrt{\sec. m : \sec. s. \cos. x. \cos. (x-d). \cos. m'. \cos. s'}$$

$$\sin. \frac{D}{2} = \sqrt{\sin. \left(\frac{m' + s'}{2} + \theta \right) \sin. \left(\frac{m' + s'}{2} - \theta \right)}$$

Computation.

$$\begin{array}{r}
 d = 96 \ 10 \ 0 \\
 m = 10 \ 36 \ 0 \quad \sec. = .007475 \\
 s = 23 \ 50 \ 0 \quad \sec. = .038710
 \end{array}$$

$$130 \ 36 \ 0$$

$$\begin{array}{r}
 65 \ 18 \ 0 \quad \cos. = 9.621038 \\
 30 \ 52 \ 0 \quad \cos. = 9.933671 \\
 11 \ 24 \ 54 \quad \cos. = 9.991323 \\
 23 \ 47 \ 59 \quad \cos. = 9.961402
 \end{array}$$

$$17 \ 36 \ 26 \quad 19.553619$$

$$\theta = 53 \ 15 \ 45 \quad \cos. \quad 9.776809$$

$$70 \ 52 \ 11 \quad \sin. \quad 9.975329$$

$$35 \ 39 \ 19 \quad \sin. \quad 9.765602$$

$$19.740931$$

$$47 \ 54 \ 38 \quad \sin. \quad 9.870465$$

$$2$$

$$95 \ 49 \ 16$$

$$17$$

$$95 \ 48 \ 59$$

N.A. Dist 12H.

$$95 \ 40 \ 9$$

$$P.L. \quad 3383$$

$$8 \ 50$$

$$P.L. \quad 1.3091$$

T. G. M. T.

$$12 \ 19 \ 15$$

$$9708$$

T. M. T. at P.

$$4 \ 39 \ 12$$

Longitude

$$7 \ 40 \ 3 \ W.$$

$$60$$

$$4)460 \ 3 \ 0$$

Longitude

$$115 \ 0 \ 45 \ W.$$

Result by Lunar of 15th

$$115 \ 8 \ 0 \ W.$$

" " 16th

$$0 \ 45 \ W.$$

$$8.45$$

Longitude of Site of Old Bow Fort

$$115 \ 4 \ 22 \ W.$$

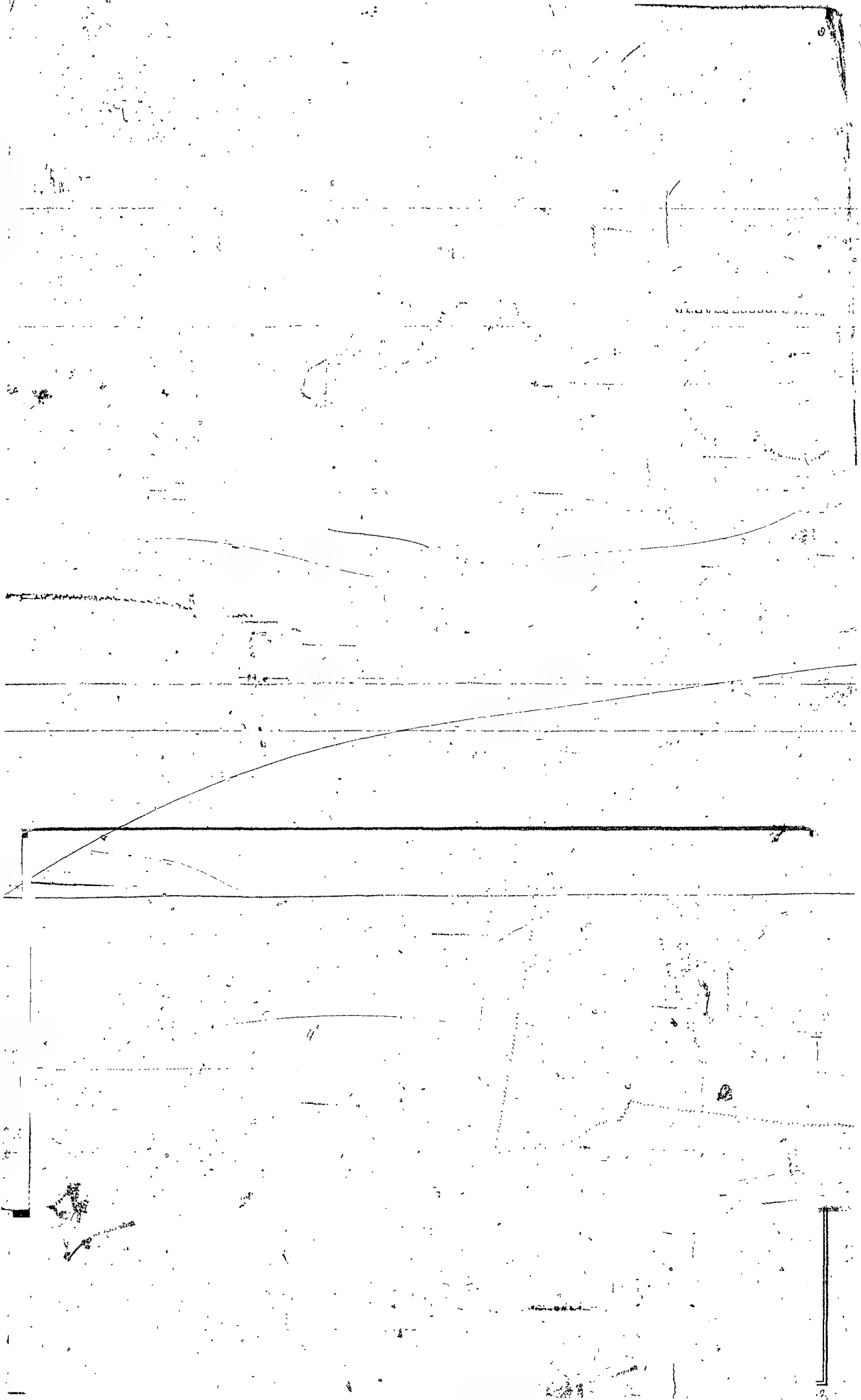
JOHN PALLISER, Capt.,
Commanding N.B. America Exploring
Expedition.

LONDON:

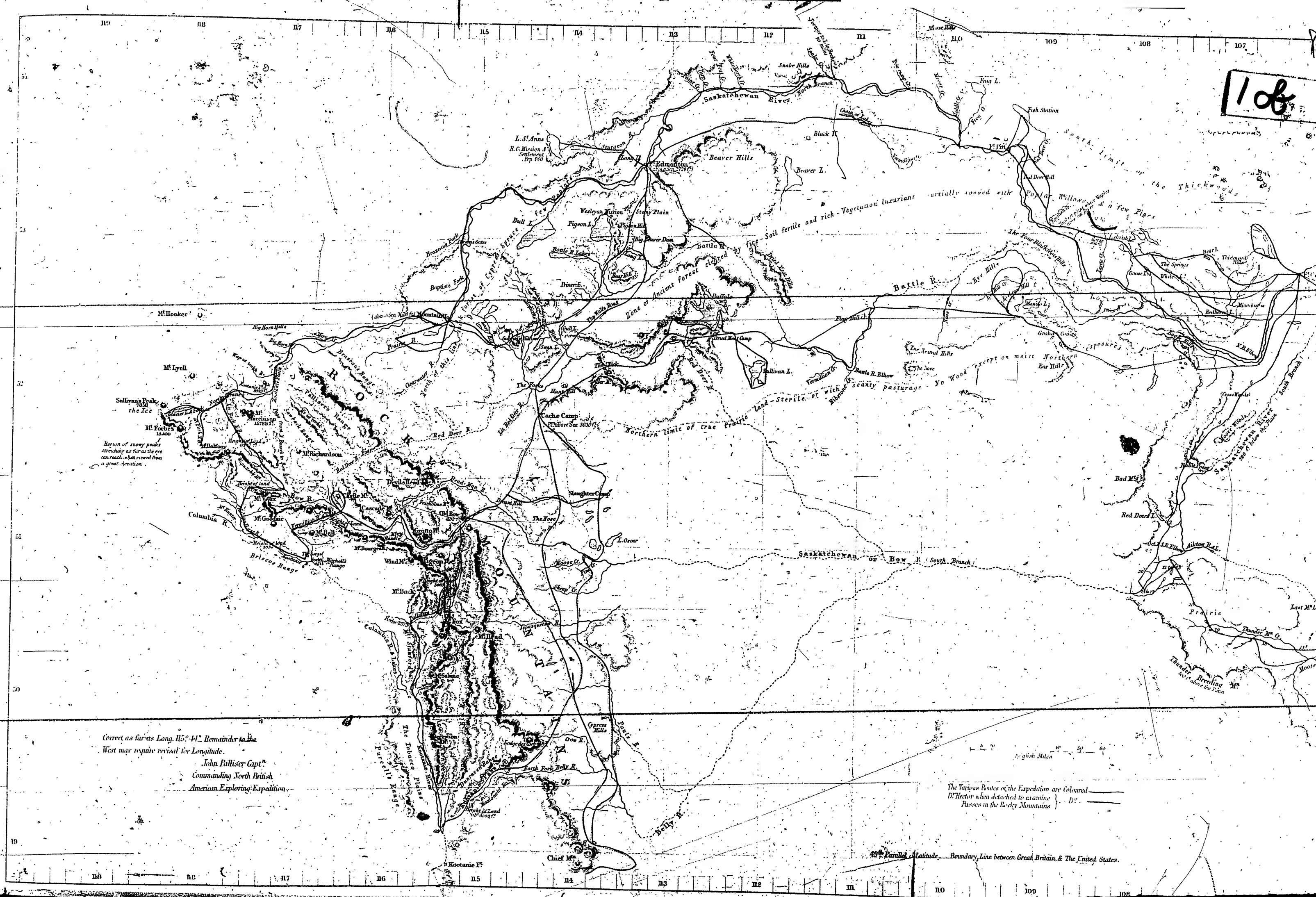
Printed by GEORGE E. EYRE and WILLIAM SPOTTISWOODE.

Printers to the Queen's most Excellent Majesty.

For Her Majesty's Stationery Office.



106



Correct as far as Long. 115° 41'. Remainder to the West may require revision for Longitude.
John Palliser Capt.
Commanding North British American Exploring Expedition.

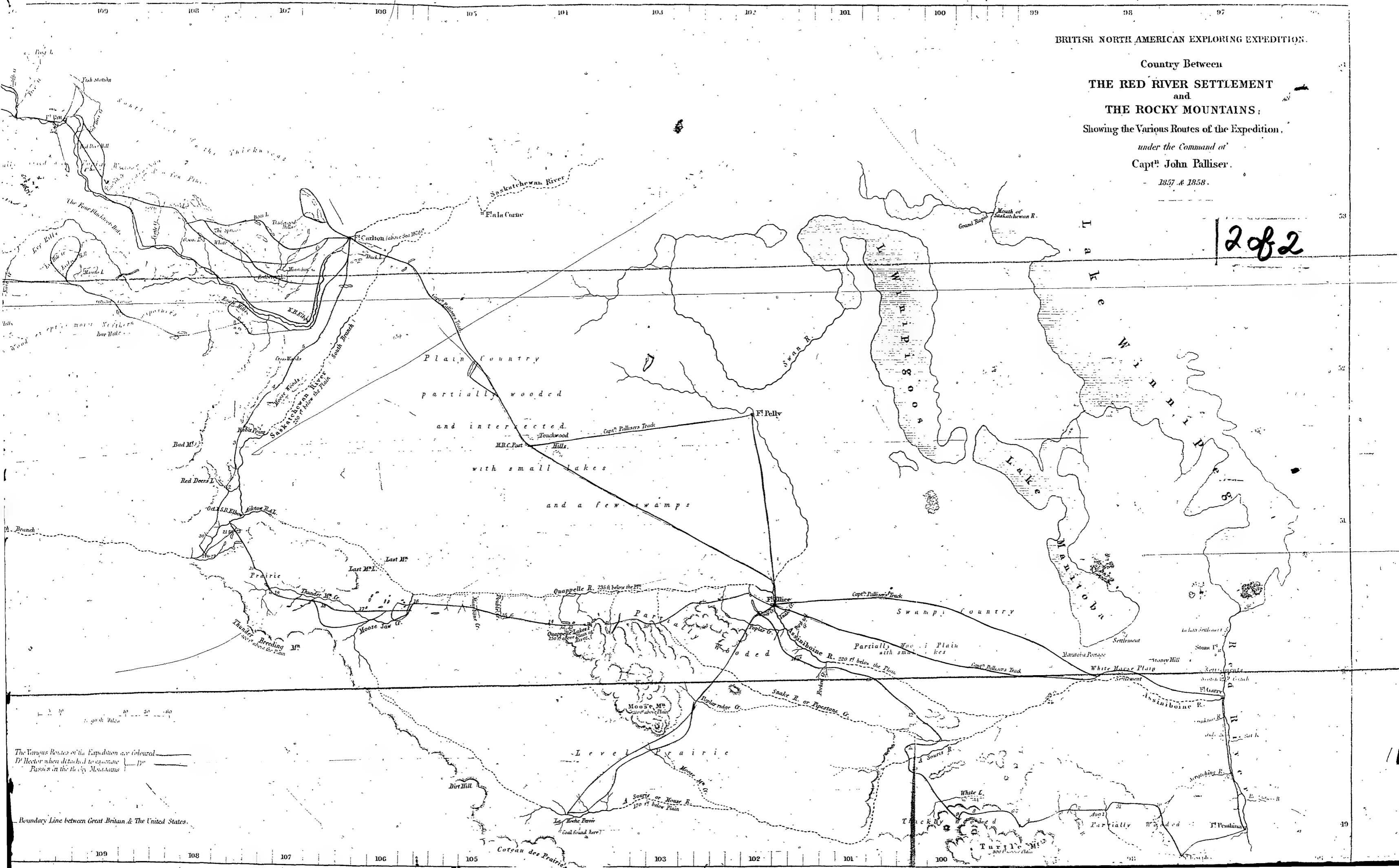
The Various Routes of the Expedition are Coloured
Dr. Hector when detached to examine
Passes in the Rocky Mountains

49th Parallel Latitude Boundary Line between Great Britain & The United States.

Country Between
THE RED RIVER SETTLEMENT
and
THE ROCKY MOUNTAINS;

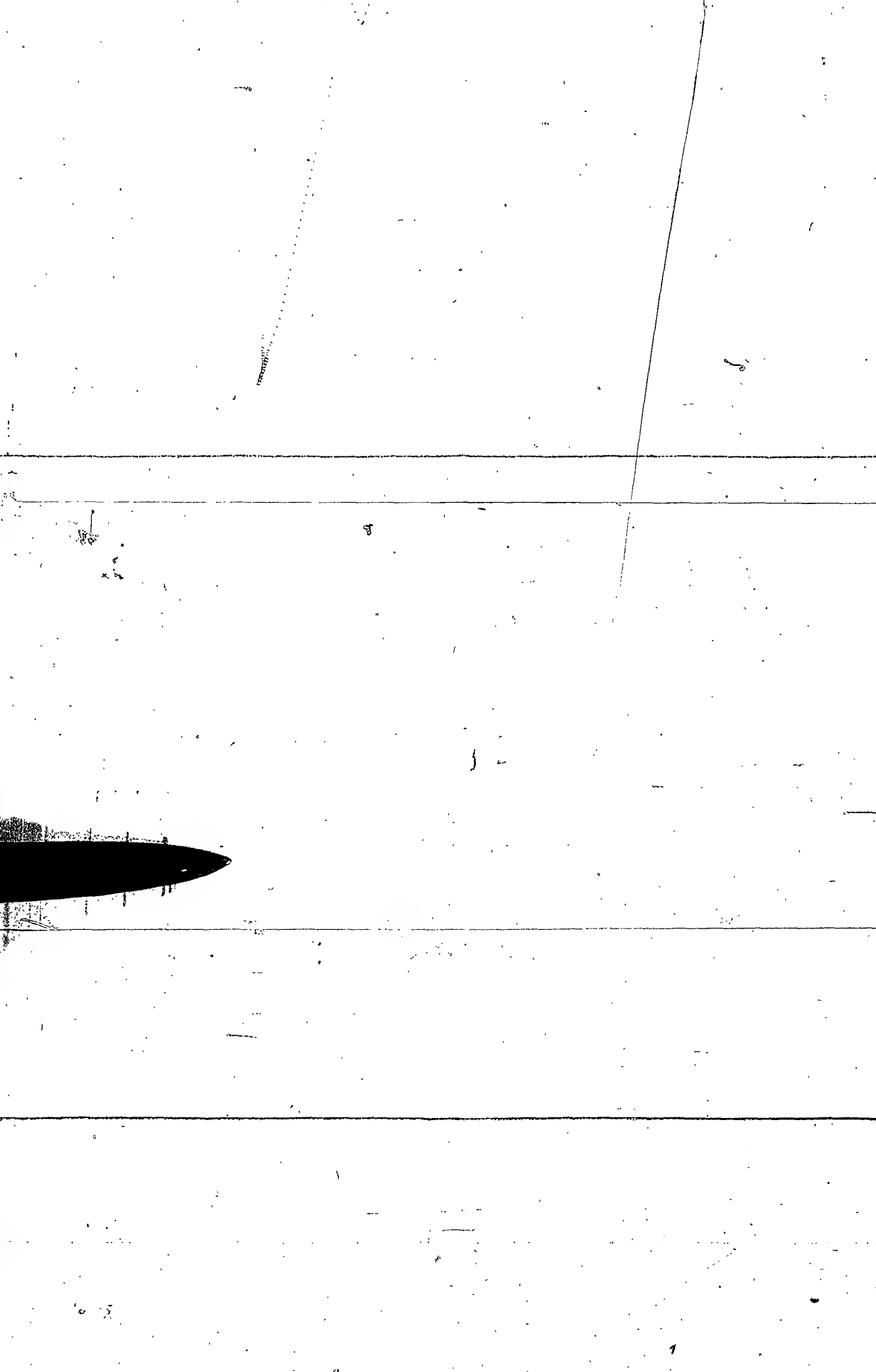
Showing the Various Routes of the Expedition,
under the Command of
Captⁿ John Palliser.
1857 & 1858.

282



The Various Routes of the Expedition are Coloured
Dr. Hector when detached to examine
Passes in the Rocky Mountains

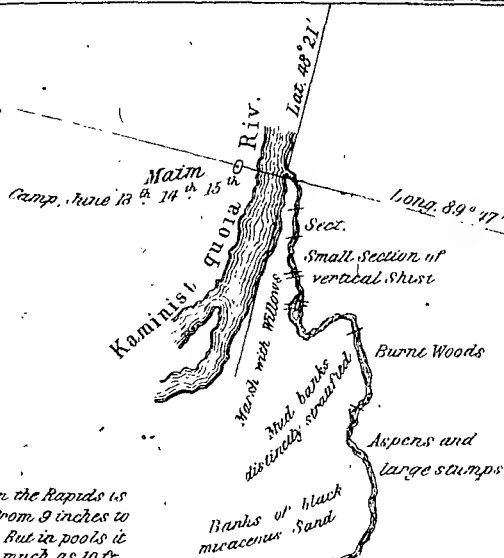
Boundary line between Great Britain & The United States.



Sketch
of the Lower portion of
WHITE FISH RIVER.

by
John Palliser, Esq^r

1857.



The water on the Rapids is generally from 9 inches to 1 foot deep. But in pools it reaches as much as 10 ft.

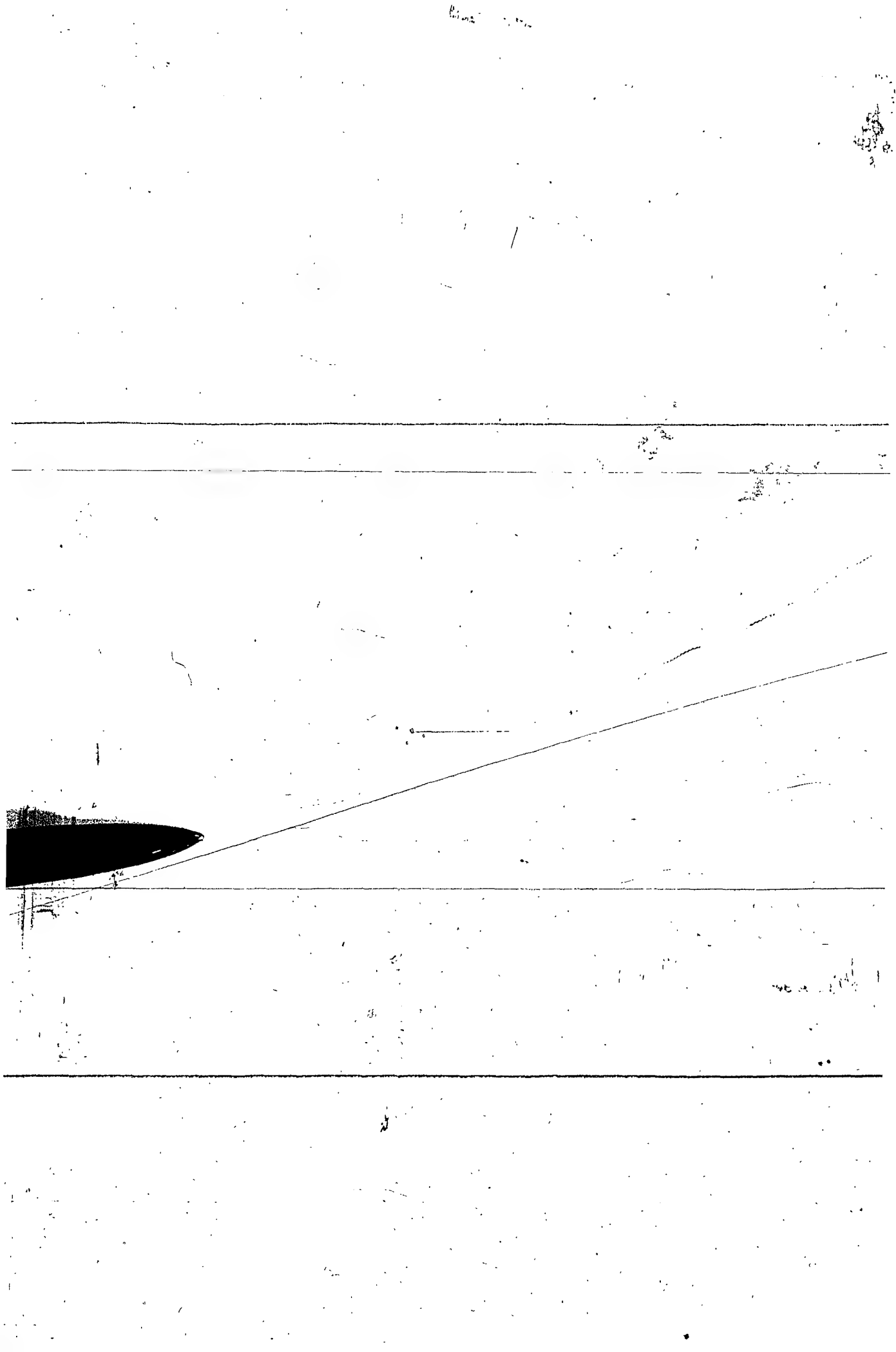
The valley of this River is not as rich as the lower part of the Kaministiquia. The wood is however equally fine at some places, but there is very little of it. The banks being principally clothed with soft aspen, Balsam, Poplars, Tamarcs & Willow.

High ridge densely wooded.
Many large Granite & gneiss strewn in the stream.
Hills of drift all along left is here
Stream strewn with Boulders
Elevation above mouth 75 ft.
The same ridge is again seen in section, but on the opposite side of the River. These two and one further up the stream are the only points where there is not considerable extent of level ground on both sides.

The country here forms a high Plateau of Drift sloping gently to the Kaministiquia, but towards the White Fish R. it is broken up into numerous ridges separated by deep gullies that run S.E. and in which the headwaters of the latter river run. This Plateau is covered with Larch wood forming a plantation free from underwood. No swamp, except close to the Kaministiquia, where also the Larch is replaced by Cypress and the underwood become very dense.

Several lofty sections are here exposed consisting of 5 to 7 ft. of a dark argillaceous Shale, stratification horizontal, somewhat jointed & fissured with many Quarz veins; this being capped by 20 to 30 ft. of dark colored Drift. Boulders are plentiful in the bed of the stream, principally of Gneiss.

This Map is only approximately true - The distance not having been obtained by exact measurement.



The Country is composed of Granite, presenting smoothed & rounded knolls and ridges, which latter trend N.W. & S.E. Dense but fine wood prevails wherever there is a sufficiency of soil, but there is not the same luxuriant vegetation that exists towards the Lakes Superior and Winnipeg.

Camp 28th June

Width of River abt 140 Yds.

Rapids to about 100 ft. of fall.

The shores of these Lakes seem to be everywhere steep & rocky and though not precipitous yet quickly reach a considerable elevation at most points.

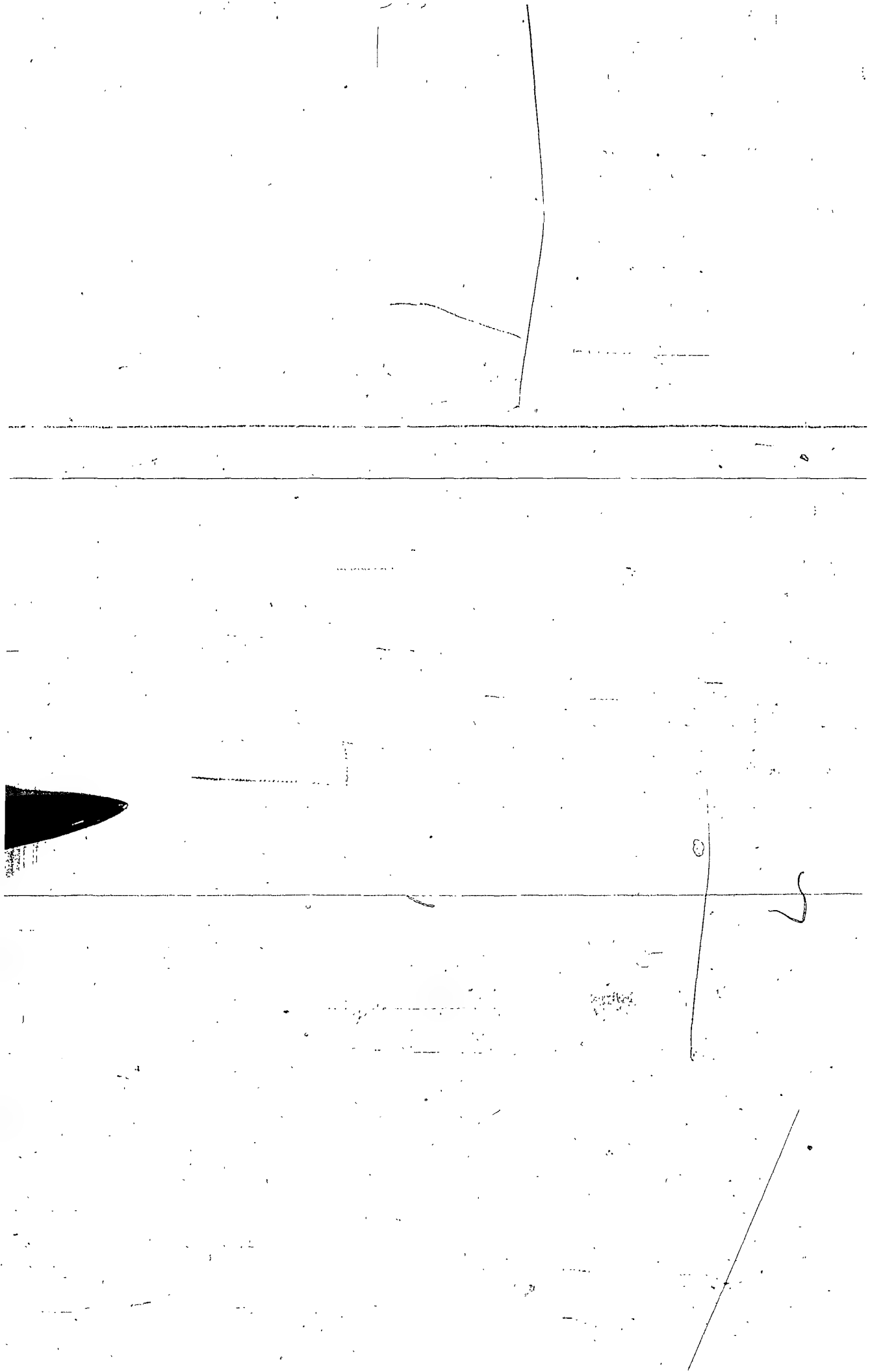
Route

Route

Shores rise as far as hills

Very large Lake Shores high, rocky and finely wooded

Ver 28th June



Sh. 1.

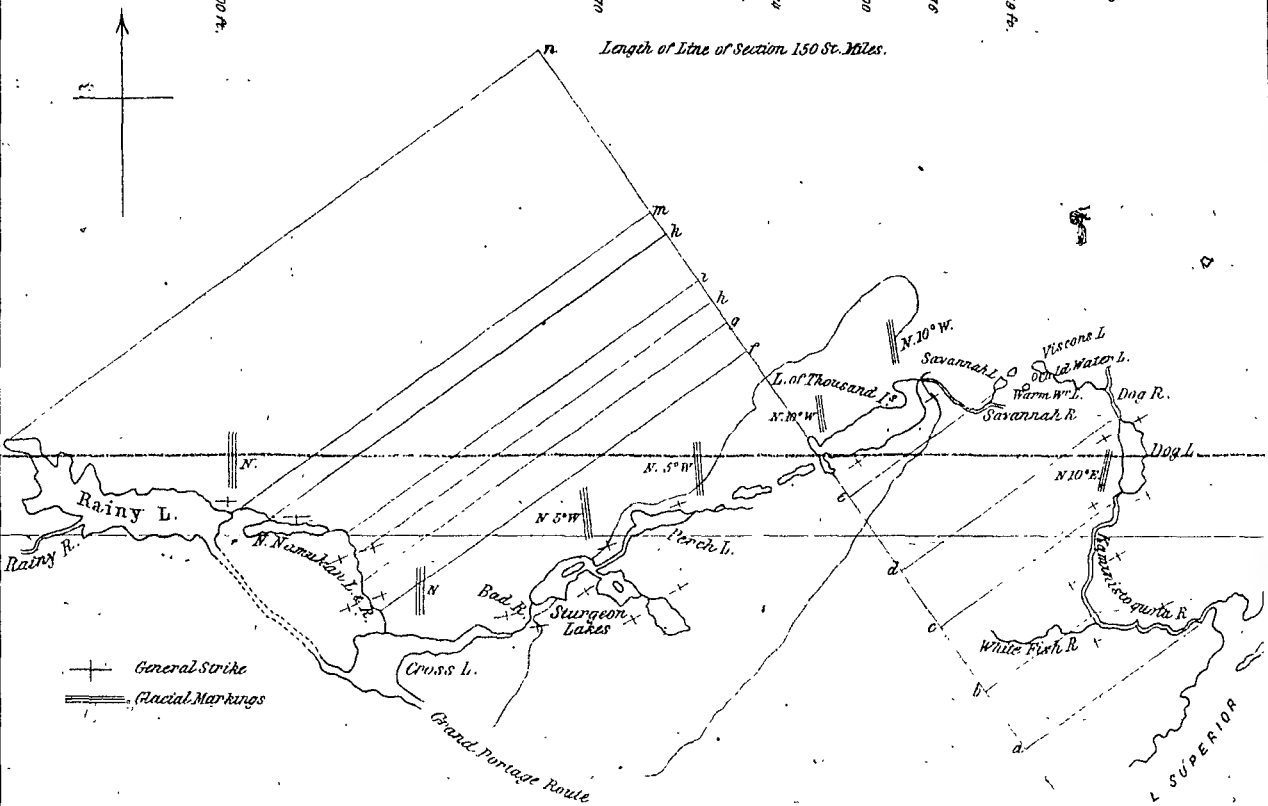
Sh. 1

Metamorphic Rocks
with Granite Intrusions

Red Marl Barite
of L. Superior
a Semimetallic
o Argillaceous Shist

n 300 ft. m k l h g f e d c b 718 ft.

Length of Line of Section 150 St. Miles.



Sh. 2

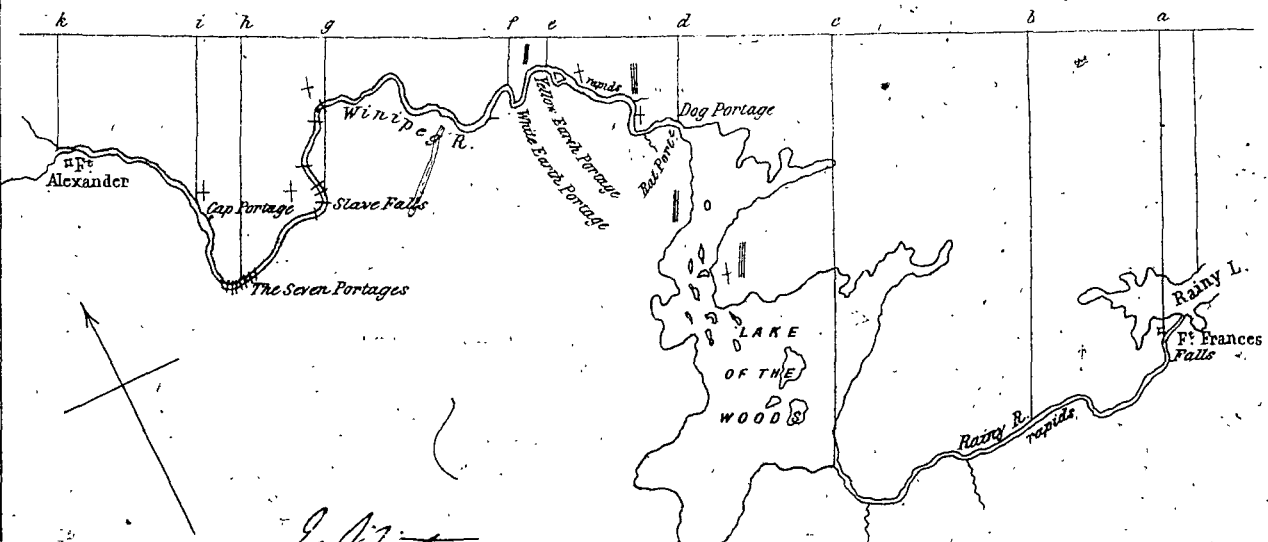
Sh. 2

3 distinct Drift Levels

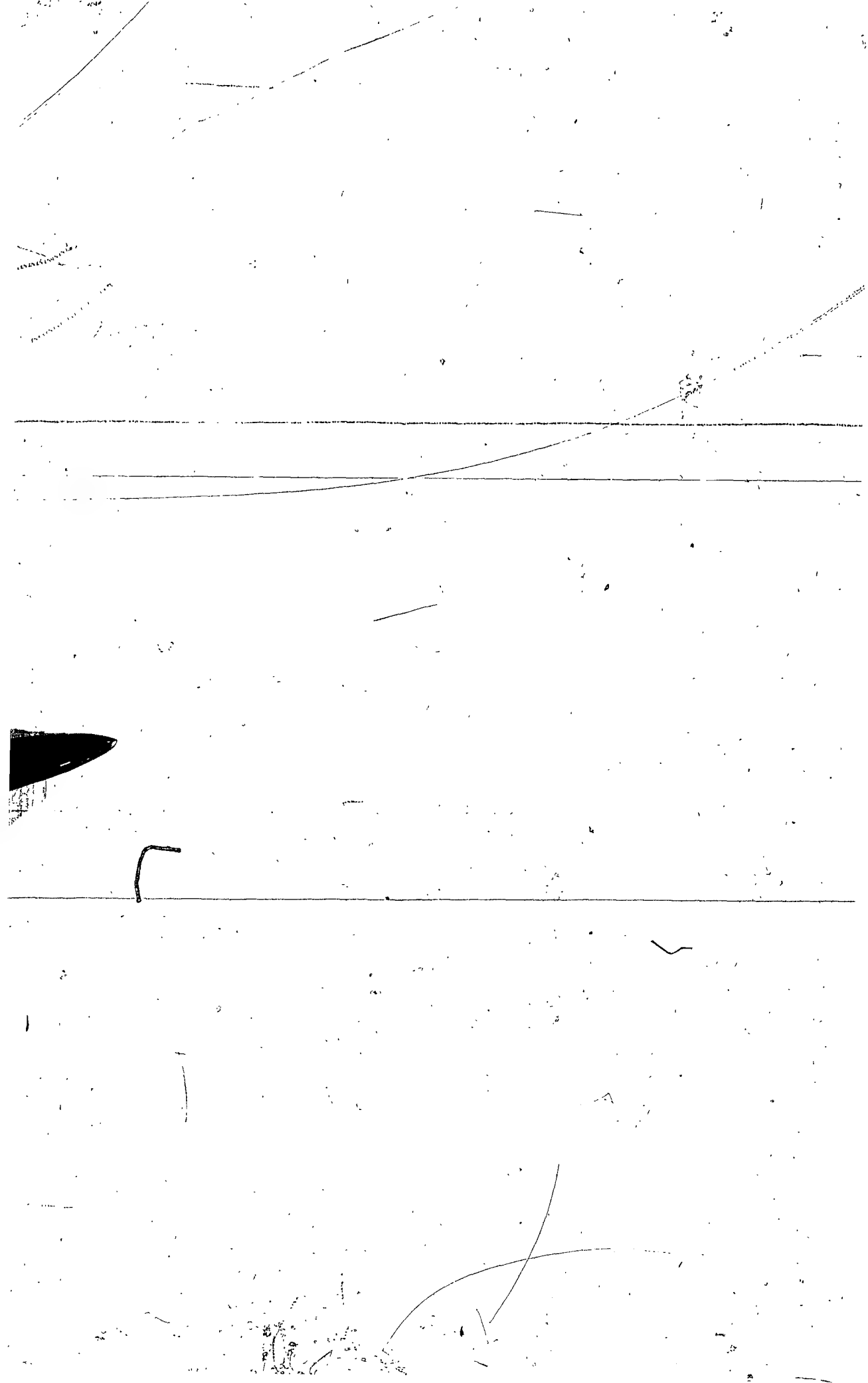
Drift

Metamorphic Rocks
with Granite Intrusions

Silurian Limestone k i h g f e d c b a 500 ft.



J. Motter. 1858.

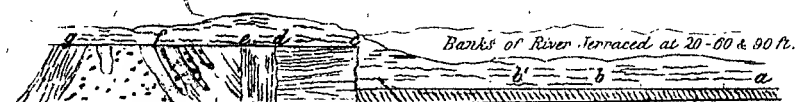
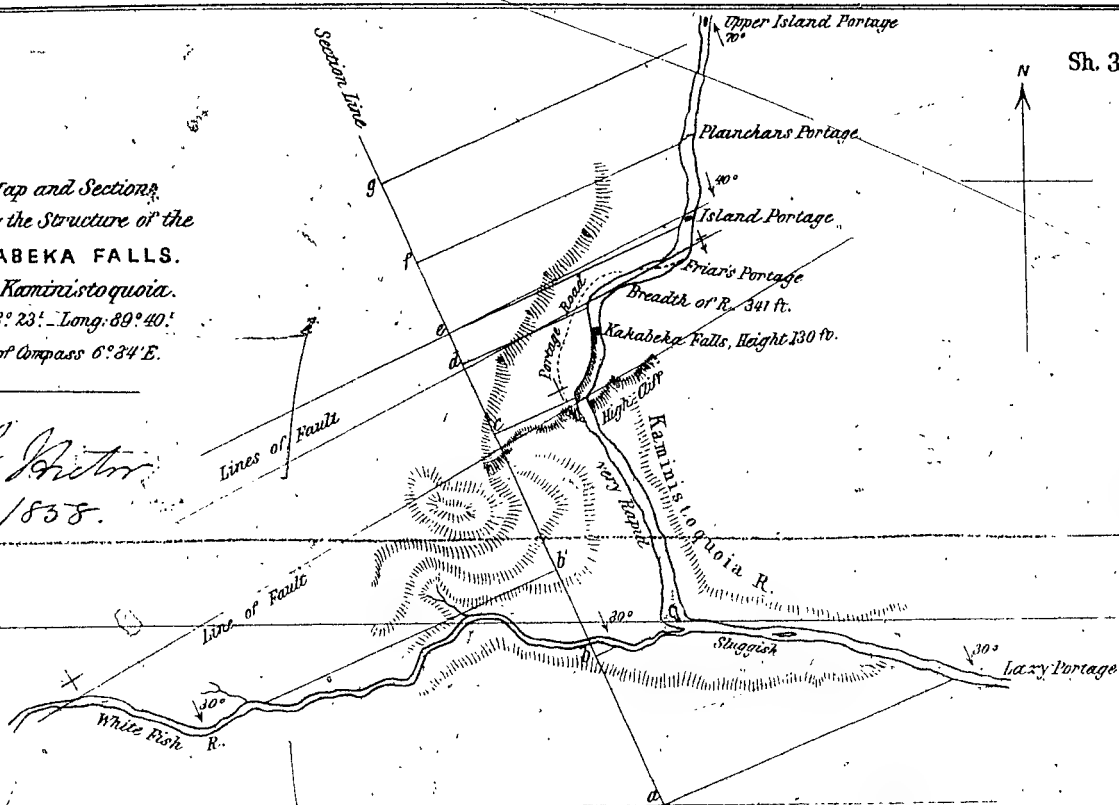


Sh. 3

Sh. 3

Map and Section.
Showing the Structure of the
KAKABEKA FALLS.
River Kaminiistoquoia.
Lat. 48° 23' - Long. 89° 40'
Var. of Compass 6° 34' E.

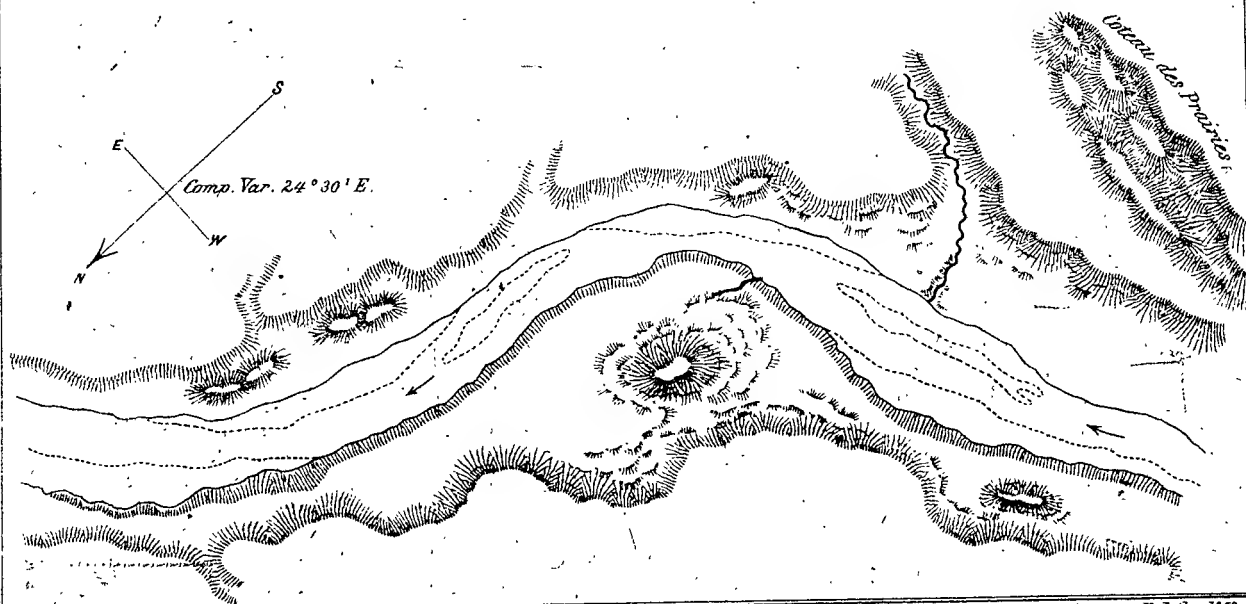
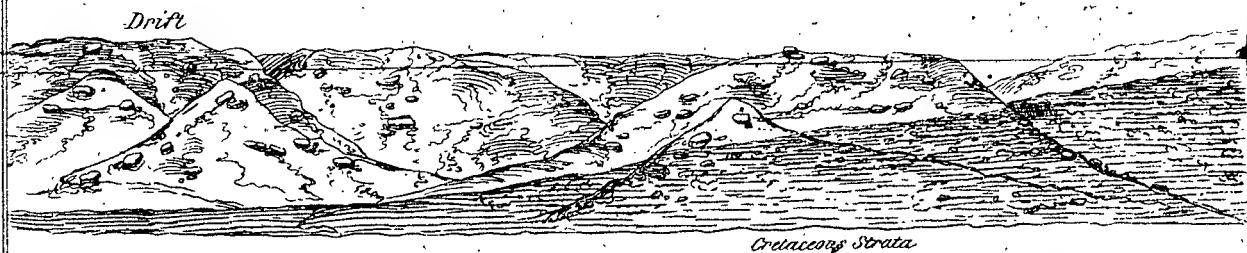
J. Victor
 1858.

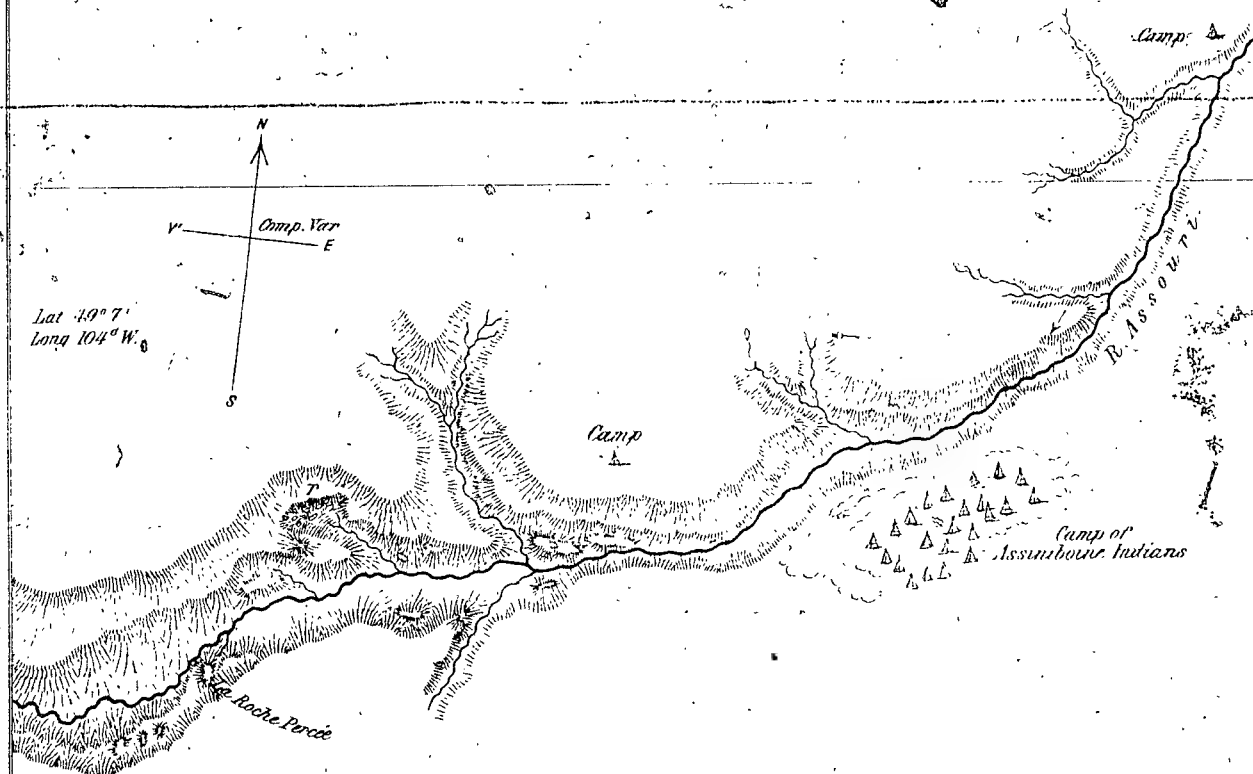
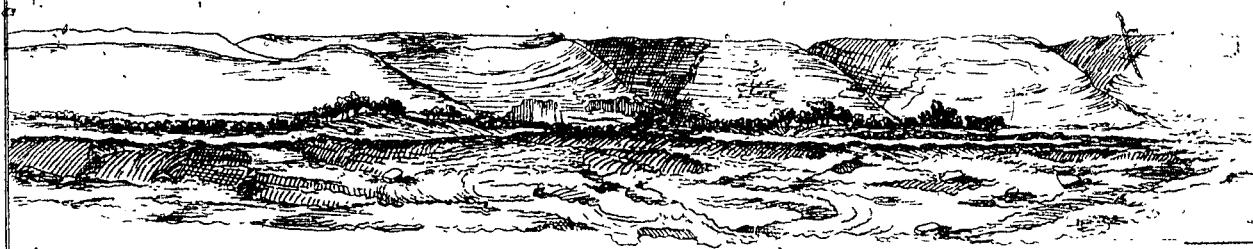


Sh. 4

Sh. 4

Section and Map. - So. Branch of R. Saskatchewan. Lat. 50° 54' Long. 107° 30'





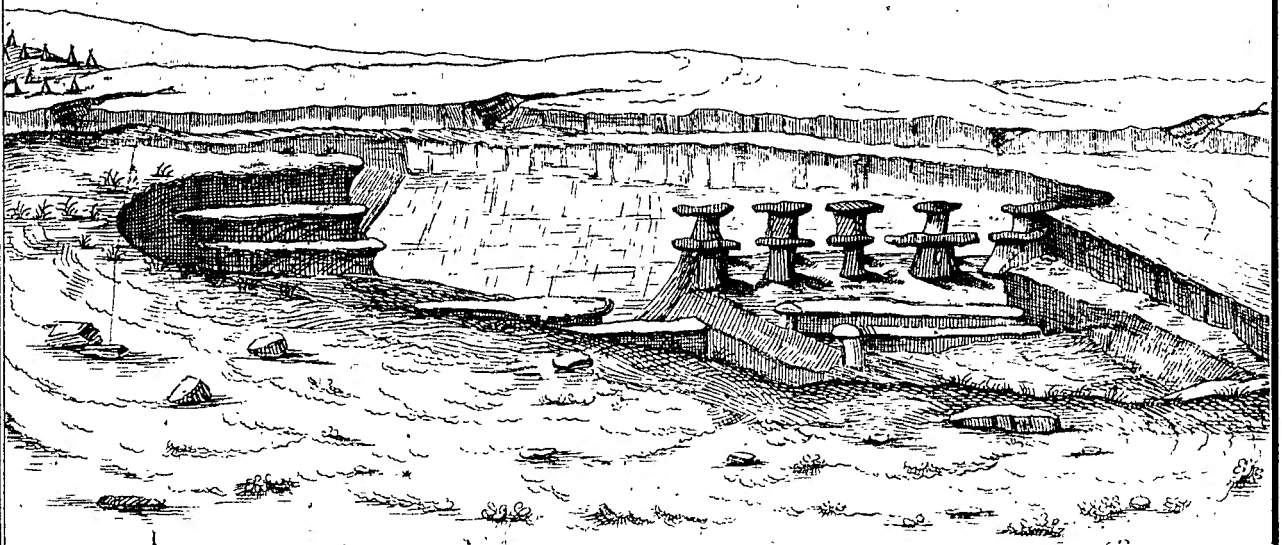
Section of the Valley of the Assouri R. at "La Roche Percée".

J. Victor 1858

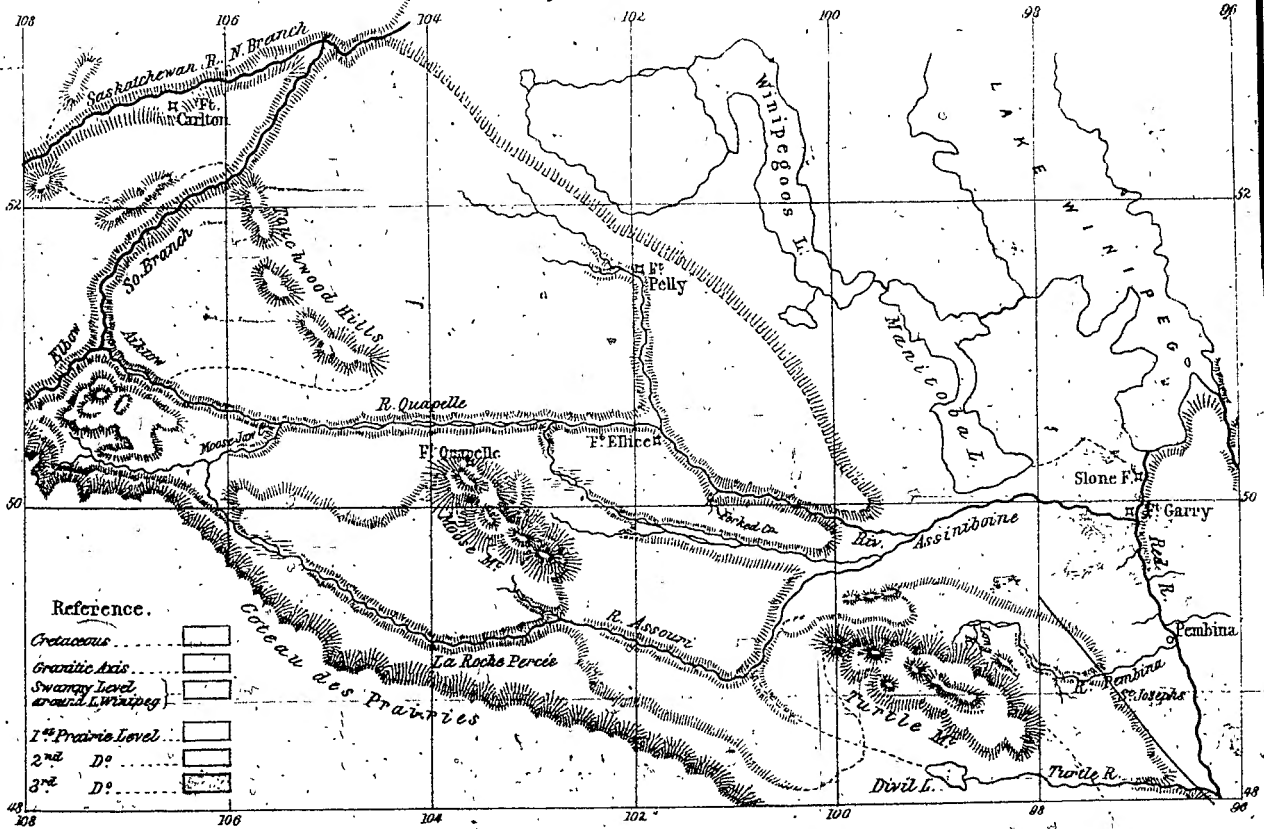


Sandstone Concretions.
Creek on Assouri R. (Roche Percée.)

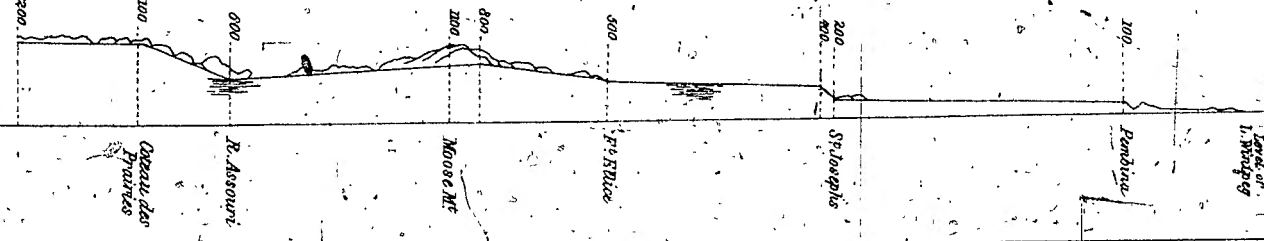
J. H. R. 1858.

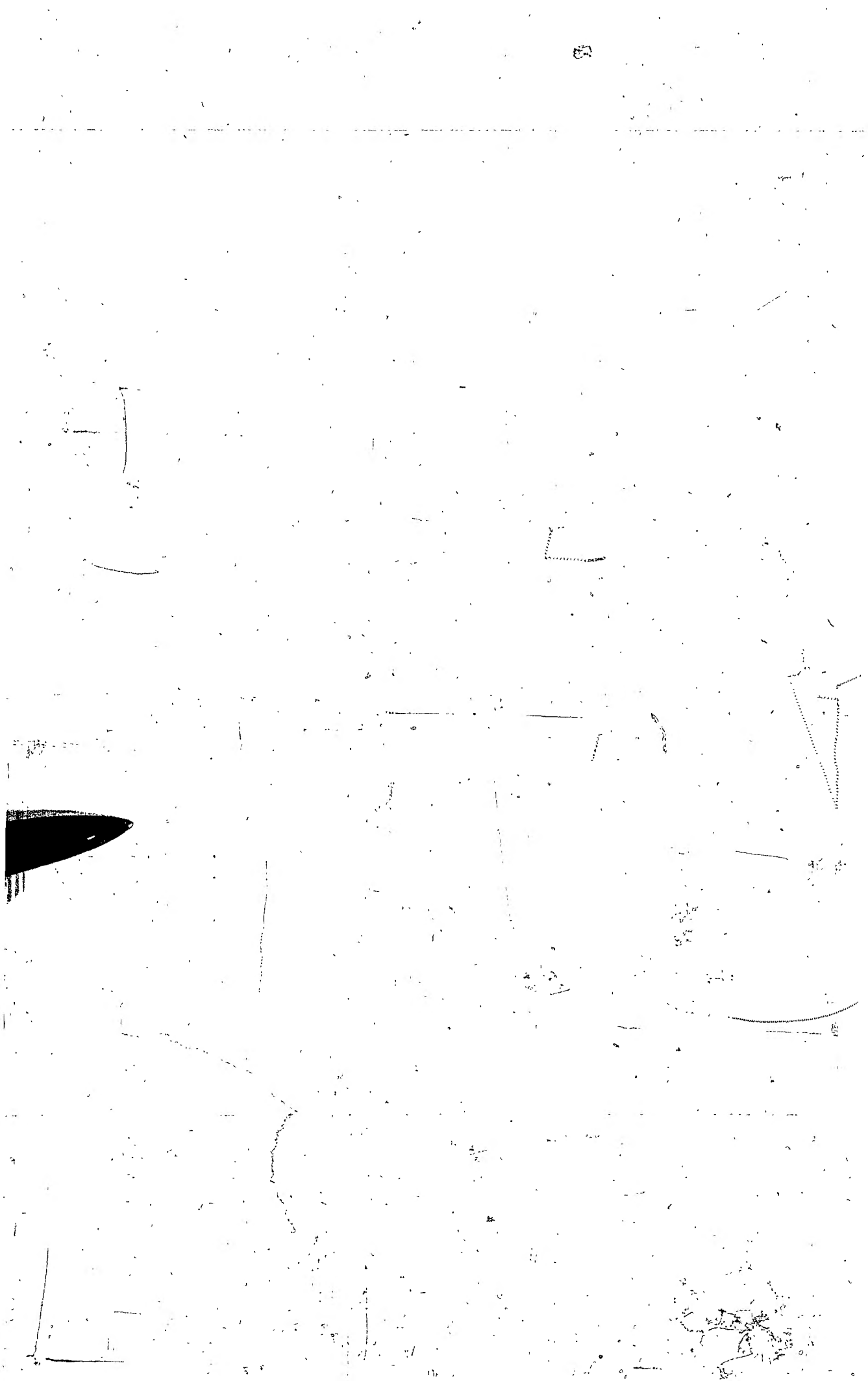


Map of Winnipeg Lake Basin. Showing the distribution of the Superficial deposits.

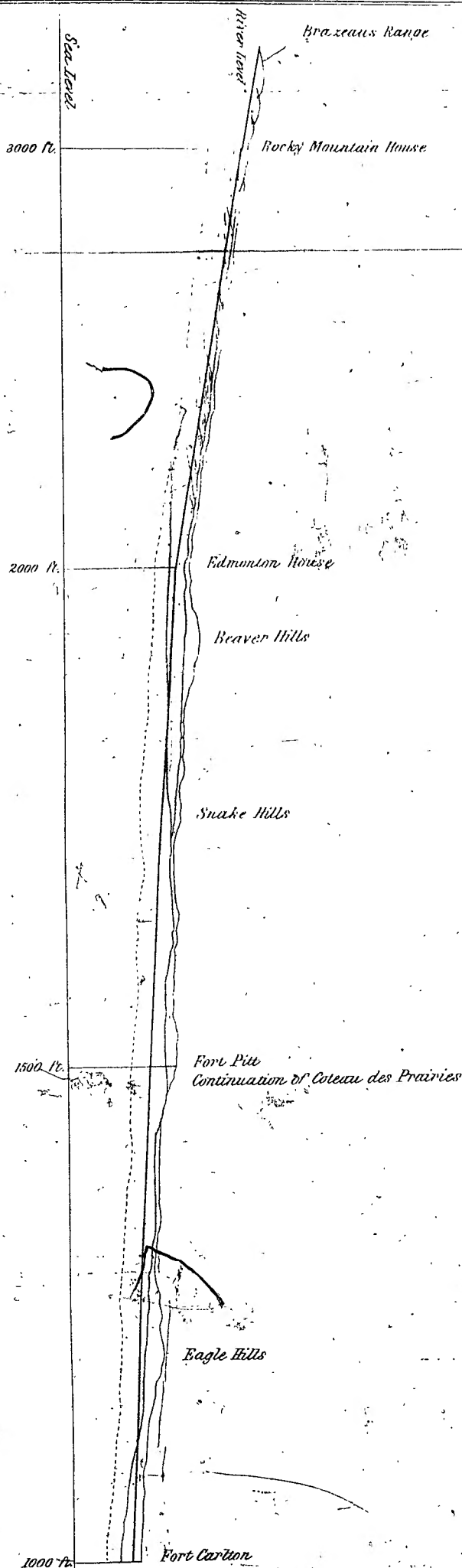


Section from Lake Winnipeg to Coteau des Prairies.





SECTION. — SASKATCHEWAN RIVER, NORTH BRANCH, FORT CARLTON TO MOUNTAIN HOUSE.



Drift. Coarse Sand, Shingle &c. with Boulders, consisting of large angular and rounded fragments of Mesozoic limestone and Azoic rocks.

Beds of Clay, Shale, Sandstone and Limestone with seams of (red) - Upper Sandstones, greenish-grey; Lower Sandstones, red.

Chalk, or Mottled. Calcareous and sandy clays with *Spirifer* which contain fossils, viz: *Beudantic*, *Tracerasmus*, *Lucina* &c.

These beds vary from Ash-grey to a purple brown.

J. M. Smith 1858